CONVERGENT GROUP

State of North Dakota

Plan and Business Case for GIS Integrated Services Model

April 2000
Convergent Group - U0331

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Introduction

BACKGROUND

In March, 2000, the State of North Dakota (State) retained the services of Convergent Group to assist in the development of a cost effective, statewide Geographic Information System (GIS) strategy with the following goals:

- Leverage the State's historic investments in GIS technology
- Provide access to additional users who will benefit from GIS technology
- Provide a vision for linking GIS and other information technologies (including eBusiness services) to enhance the State's ability to provide on-line services to the constituents of North Dakota
- Eliminate interagency redundancies
- Provide recommendations to reduce risk and ensure a successful implementation of GIS statewide.

The immediate focus of this effort was to rapidly produce a high-level plan and business case to present to decision makers for approval and to develop budget estimates for use in the upcoming biennial budget year.

Convergent Group worked toward the following objectives:

- Survey the State to assess current GIS activities and initiatives
- Identify where additional value and opportunities may be gained

Introduction

- Identify improvements and develop a strategy for implementing them
- Develop a business case to support this strategy

DEVELOPMENT OF THIS REPORT

This document details the results of a 30-day effort to develop a high-level plan, budgetary estimates, and a business case to support an enterprise GIS strategy for the State of North Dakota.

Much of the information gathered to support this effort was obtained through interviews with representative GIS users from several state agencies. These agencies included:

- Information Technology Department
- Department of Game and Fish
- Parks and Recreation Department
- Water Commission
- North Dakota State University -Transportation Institute
- North Dakota Geological Survey
- Department of Transportation
- Labor Department
- Health Department

Introduction

- Economic Development and Finance Department
- Aeronautics Commission

The information required to support the development of the plan, budgetary estimates, and business case, presented herein, was gathered at a level of detail that could accurately and efficiently be accomplished within limited duration of this effort. Convergent Group relied on its significant experience as a public sector systems integrator to supplement the information gathered during this effort.

ORGANIZATION OF THIS REPORT

This report is organized into the following sections:

- Section 1 - Introduction
- Section 2 - Findings & Conclusions
- Section 3 - Departmental Interview Summaries
- Section 4 - Recommended Solution
- Section 5 - Implementation Strategy
- Section 6 - Business Case Details
- Appendix A - Interview Notes

Findings and Conclusions

SUMMARY OF FINDINGS

Convergent Group consultants conducted a series of interviews with representatives from the State's Information Technology Department and several of the State's key GIS user agencies. The following points represent key issues and findings discovered during these interviews.

- Most of the departments interviewed would benefit from a standard base map that could serve as a basis for project planning and as a base layer upon which to overlay project data and perform analysis.
- Departments that perform field survey/mapping work need essentially the same field data collection and editing functionality. This includes:
  - The ability to collect GPS locations.
  - The ability to associate a wealth of attribute details to GPS locations.
  - For some users, the ability to sketch ad-hoc polygonal areas that indicate project/study areas, management areas, or other areas of interest.
- Most departments have the need to capture and track historical time-series data for studies.
- All departments indicated the desire to support Internet access to their data sets and project findings - many have initiatives currently underway.
- All departments indicated a need for more budgetary resources to properly maintain their data sets.

Findings and Conclusions

- Most departments indicated a lack of tool training.
- Most departments requested improved and centralized technical support.
- Most departments indicated a desire for a centralized GIS coordination function. In many instances this was perceived as an ITD role.

CONCLUSIONS

Given the findings listed above and the State's desire to reduce redundancies and provide access to additional users who will benefit from GIS technology, in accordance with the State Executive Order 1995-05, Convergent Group concludes that an enterprise approach to statewide GIS implementation needs to be adopted by the State of North Dakota.

Multiple GIS initiatives are currently underway within several state agencies. The majority of these are departmentally focused. In Convergent Group's experience, GIS strategies built upon multiple departmentally focused initiatives tend to promote redundancies, increase aggregate costs, and reduce efficiencies; whereas properly constructed enterprise GIS strategies result in reduced redundancies, greater efficiencies, and greater cost/benefit value.

Though there are multiple departmentally focused GIS efforts currently underway, GIS investment within the state, as a whole, has been fairly limited. Because of this, Convergent Group contends that there is little to be lost and much to be gained in adopting an enterprise approach to GIS. The State is in a prime position to leverage much of what individual departments have already invested in GIS.

Findings and Conclusions

If, however, GIS implementation continues as a series of uncoordinated, incremental, departmentally focused efforts, it is very likely that these efforts will result in fewer opportunities to leverage historic investment and higher overall implementation costs. This same multiplicity of vertical investments will increase diversity and aggregate cost at an ever-increasing rate.

Convergent Group recommends that the State of North Dakota adopt an enterprise approach to statewide GIS implementation as soon as possible, due to the factors and conclusions stated above.

Solution

GIS Integrated Services Model

1. Technical Architecture: Enterprise GIS Hub
2. Data Architecture:
   - Departments required to publish products and finished data
   - Departmental awareness of data
   - Departmental working data sets
   - Enterprise (ITD) published and quality controlled data and product repository

Findings and Conclusions

3. Analysis:
   - Departmental responsibility to generate required products
   - ITD responsibility for usage, overall quality, currency
4. Maintenance:
   - Departments use common data maintenance tools for their data
   - ITD responsible for enterprise data published to the Hub
   - ITD responsible for enterprise database administration through an assigned DBA resource
5. Management:
   - Coordinated implementation and management of statewide GIS to be achieved through new ITD position – GIS Program Manager, reporting to the Software Development Services Manager

An Enterprise GIS Hub, as the foundation fo a GIS Integrated Services Model, will allow statewide access to data, promote sharing of GIS data that resides in departmentally based GIS systems, and provide a platform for external (the public and/or other external agencies) access to State data through a State Internet Web portal.

A detailed description of the type of enterprise GIS hub envisioned for the State of North Dakota is provided in Section 4 of this document.

Findings and Conclusions

A detailed discussion of the benefits of implementing an enterprise GIS approach supported by an enterprise GIS hub can be found in Section 6 of this document.

Table 2-1, below, summarizes Convergent Group's findings and recommendations.

TABLE 2-1 SUMMARY OF FINDINGS AND RECOMMENDATIONS

Findings Summary	Recommendation Summary
Need for a standard base map	Published, quality controlled base maps accessible through an Enterprise GIS Hub
Need for standard tools	ITD to establish common platform and provide technical support for non-departmentally unique analysis tools served through an Enterprise GIS Hub architecture
Need for common data usage	Access and control served by Enterprise GIS Hub
Need for temporal analysis capability	Publish quality-controlled data, accessible through a common location statewide
Need for Web access to products and data	Serve through Web-portal aspects of Enterprise GIS Hub

Findings and Conclusions

Findings Summary	Recommendation Summary
Need for more maintenance funding	Control maintenance costs, partially through common storage on Enterprise GIS Hub. Reduce aggregate cost by assigning one Database Administrator to the Enterprise Hub this reducing departmental data maintenance redundancy
Need for more training	Assign a GIS Coordinator/Program Manager within ITD to administer training plan Consolidation of support roles within ITD reduces number of personnel to be trained Leverage training needs across agencies to obtain volume discounts Institute a GIS user support group to leverage internal knowledge and skills.

Findings and Conclusions

Findings Summary	Recommendation Summary
Desire for centralized technical support and coordination	Assign a GIS Coordinator/Program Manager within ITD to administer commonality, manage redundancy, provide technical clearinghouse, and liaison with other state agencies.
State GIS license costs are uncontrolled and too high	Renegotiate a centralized statewide ESRI procurement contract. GIS purchases should be technically cleared by ITD GIS Coordinator to better leverage volume discounts and maintenance savings offered in contract
ED&F does not have the budgetary means, data sources, technology to achieve its mission of “Growing North Dakota”	GIS Integrated Services Model will support this need when ED&F has sufficient funding

Departmental Interview Summaries

A summary of the information obtained through departmental interviews appears in the following table (Table 3-1). Copies of detailed interview notes can be found in Appendix A of this document.

TABLE 3-1 SUMMARY OF INTERVIEWS

Department	Data Sets/Products Generated	Areas of Interest or Management	Data Sets Used or Would Used	GIS Applications Developed	GIS resources	GIS users
Game and Fish	The department generates and maintains species distribution maps and lake contours as well as their survey databases. The department maintains the license database and the infraction database.	The department has the following areas of interest: species management areas, hunting units, game warden districts, and survey locations.	USGS quads NDOT county maps USF&W maps Ground cover Habitat Vegetation Crop Livestock Water Quality	No GIS based applications at this time.	Would need to bring in temporary expertise to train its users. Would prefer to use a service provider for applications and reports needed.	25
Parks & Recreation	The department generates and maintains tall grass inventory maps, mixed grass and native prairie, inventory of all native communities and is starting to collect facilities and park layout maps. Does provide data sets to:	Ad-hoc areas of interest for projects or study areas. Also need management areas for state parks, county boundaries, state boundary, and township, range,	USGS quads NDOT county maps USGS PLSS Roads Cities, Towns Hydrology Aerial photos of parks USF&W maps	No formal applications, though does use GIS to review environmental impacts of other state projects.	Does subcontract out for help on a per project basis.	45

Departmental Interview Summaries

	US Forest Service, Northern Prairie Ducks Unlimited, Nature Conservancy	and section areas.	US Forest Service ND Game & Fish			
Water Commission	The department generates and maintains water quality well inventory, precipitation database, wetlands inventory, aquifer delineation, basin delineation, and water appropriation areas for water permits. Provides data to: Health Department, Federal Agencies	Ad-hoc areas of interest for projects or study areas. Also need management areas for water appropriations and static areas such as dams, drains, wetlands, and PLSS township, range, sections	USGS quads NDOT county maps USGS PLSS LiDAR Aerial Color Infareds Hydrology Road Network 30M DEMs NDOT Soil Types Wetlands Climatic	Ground water modeling, Surface water modeling, Extensive survey, inspection and maintenance applications in 4th Dimension.	Users appeared to be self-sufficient so would estimate all would be good candidates for some GIS application development.	15
Geological Survey	The department generates and maintains the statewide geological layers at 1:24000' and 1:500000'. Maintains soils data: mineral, potash, coal, and tinker to develop 1:24000' with natural resources. Maintains civil boundaries: USA/Canadian boarder, Parks, Historic, Civil	PLSS boundaries: township, range, section and civil boundaries.	USGS quads USGS 1:100000' topos NDOT county maps NRCS orthos Corps of Engineers Missouri River Aerial Color Infared photography	Using commercial packages but no GIS applications developed yet. All attribution being collected is being managed by INFO except for the oil and gas mainframe database.	Users appeared to be self-sufficient so would estimate all would be good candidates for some GIS application development.	19

Departmental Interview Summaries

	Townships, National Parks, Forests and Scenic Waterways on seven and one-half minute quads. Is responsible to maintain an oil and gas pipeline repository. Each oil well has chemical analysis, formations and legal description.					
Health	The department generates and maintains a large number of GPS water quality survey points with associated attributes being managed in Access or Oracle. NPDS manages solid waste, radiation, UIC, storage clients, EPA and Air Quality data sets. Is currently developing overlays of disease control areas with census data on zip code areas.	County boundaries and ad-hoc study area boundaries.	USGS quads NDOT county maps ND Game and Fish USF&W EPA Road Boundaries DEMs REACH File Streams Aquifer Maps from Water Commission Water quality points from Water Commission ND Parks & Rec.	Have five power users who have developed productivity tools in AML and Avenue but no operational GIS applications. Would like to see an integration of existing environmental databases; the automation of physical sampling with the laboratory; and the integration with the LIMS.	Has five very self sufficient staff members who would be excellent candidates for some GIS application development.	50

			Image data from National Statistical Service – Land Use Flood Plains EVAC Wetlands 14 digit Hydrologic Unit Code Integrated 911 information with facilities locations Soils mapping			

Departmental Interview Summaries

DOT	The department generates and maintains the county line maps that contain a wealth of data themes including state maintained roads. The department also manages large amounts of attribution that they enter into DB2 for: road inspections, road conditions, and road maintenance.	The majority of the work managed by DOT is based on sub-sections of roads or accident points.	USGS quads State Highways Ramps Reference Points Highway Numbers Railroads County Boundaries Corporate Boundaries District Boundaries Legislative Boundaries State Boundary Park Boundaries Wildlife Boundaries Waterfowl Boundaries County Roads Bridges County Routes Railroad Crossings Traffic Count Stations Water Areas PLSS	Has developed some routing applications to show road conditions and current road maintenance projects status statewide. Did not have any maintenance or query or plotting applications for the average user.	Has two power users who could be considered resources for application development. Did indicate they would be interested in subcontracting GIS development.	55

Departmental Interview Summaries

			Cultural Points Gravel Pit Locations NGS Stations Accident Locations			
Economic Development and Finance	This department wants to develop an extensive economic development application. It will require access to most of the state generated data sets and will require parcel level detailed data sets from the counties. The primary targets are manufacturing, food processing, software development, software services, telecommunications, call center, and export services.	Ad-hoc planning or project sites.	NDOT County Maps County Parcels Census Labor Statistics Zoning Land use Community Profiles Water Commission Higher Education	Currently has subcontracted out to Kadrmas, Less and Jackson a four phase pilot.	Has one person with GIS training.	22
Aeronautics	The department maintains and manages an inventory of airports, registered aircraft owners, and registered agricultural sprayers. It generates master plans for each airport and	Five-mile radius of airports.	Aerial photos USGS quads Wetlands Roads Noise Patterns Airspace zones	No applications developed.	Subcontracts out GIS needs to Kadrmas, Less and Jackson.	

Departmental Interview Summaries

	performs pavement analysis. It produces the Aerial Airport Directory every two years.					
NDSU – Trans. Institute	Currently has projects that are tracking all grain elevators, has developed an accurate inventory of the railroad network and developing a survey of agricultural land use with production strata.		NDOT County Maps Federal DOT Federal DOA Federal RR Administration National Railway AMS Economic Research National Statistical Service	Uses a federal government developed advanced traffic analysis application.	Wealth of educated graduate students.	
Labor	The department maintains databases of labor related claims and of the educational services it provides on labor practices.	Claims are managed as point locations.	NDOT County Maps Census data Labor Market Information Major Town boundaries Municipal boundaries	No applications developed but has good vision of how to make use of GIS technology.	Would need to subcontract for GIS development expertise.	
Agriculture	The department maintains and manages a beehive inventory.	Beehive locations are managed as point locations.	NDOT County Maps	No applications developed.	Would need to subcontract for GIS development expertise.	

Recommended Solution

This section of the report provides the State of North Dakota with a detailed vision of the system architecture necessary for developing a statewide GIS Hub and a set of North Dakota branded portal applications. The system architecture, described herein, provides the technology foundation to support the State's requirements for enterprise GIS and the State's goals for enhancing its ability to provide online services to its constituents. This section establishes a road map to help guide the development of the Enterprise GIS Hub and identify related integration issues.

Enterprise GIS Hub Summary

Characteristics

The main features of a GIS HUB, as envisioned for the State of North Dakota, are as follows:

- The use of Relational Database Management System (RDBMS) replication technology to distribute spatial data to the enterprise
- The use of RDBMS remote access technology to access heterogeneous relational sources of information
- The use of a semantic data translator to support the migration of digital data from legacy systems to the Hub and to support some data correlation and synthesis to form information from various input sources of data
- The use of Web technology to support map viewing and provide increased access to data

Recommended Solution

- The use of a GIS analysis engine to support spatial analysis once all of the data sources are brought together in the Hub
- The use of middleware technology to develop North Dakota branded portal applications to support the needs of the residents of North Dakota and to facilitate integration of both legacy data sources and future applications

Benefits

The Enterprise GIS Hub provides automation to support both the publishing of various departmental data sets and the extraction of data from the Hub for use in various departmental GIS systems. The design is broken into components that support the ease of infusion new technology as it becomes available. The design maximizes the strengths of the layered COTS (Commercial Off-The-Shelf) products.

Scalability

Built into the Hub's design are three key scalability features:

1) The design supports maximization of the resource capacities of the networked servers by supporting Windows NT clustering technology.

2) The design supports increased Web user map requests by allowing more "map server" instances to be created on existing network nodes. These are used to balance the loads caused by user requests.

3) The design supports increased data extraction demands by allowing more "FME servers" to be added to existing nodes in the Hub network.

Recommended Solution

Extensibility

The design of the Hub supports better than linear performance increases when adding either CPUs to existing nodes or when adding more nodes to the network. Most of the Hub's components support using multiple instances. This means that these components can be moved to new nodes, as appropriate, without the end users needing to worry about which nodes run which kind of software. This also allows the tuning of a node to support a well-defined set of workload requirements. The data distribution design supports the addition of new departments by allowing each department to have full control over its data maintenance activities and determining the publishing schedule it wants to sign up to support.

System Components

Server Components

The GIS Hub has been designed into services that provide the foundation for application server, database server, map server, data publishing and data extraction functionality. As highlighted in Figure 4-1 (page 4-8), the server set of components includes development and configuration service components in addition to COTS products.

Spatial Database Service

This service provides the data storage and concurrency controls to support multiuser access to spatial information. The COTS products that will be used to build this service are Oracle8i RDBMS and ESRI's SDE 4.0. Along with providing the DBMS

Recommended Solution

support for vector spatial and aspatial data, this service will provide the storage for the digital orthophotography to be used as background for most of the State's base mapping needs.

Internet Map Service

This service provides the serving of maps to an end user's desktop Web browser. This service supports the generation of requests from multiple users. The COTS products that will be used to build this service are:

- ESRI's ArcIms 3.0
- ESRI's SDE 4.0
- GeoNorth's Mapoptixs
- Allaire's Cold Fusion 4.0
- Microsoft's Web Server IIs 4.0
- Microsoft's Internet Explorer 4.0
- Oracle8i RDBMS

Recommended Solution

Data Transfer Service

This service provides the ability to move data among heterogenous data sources. This service provides the periodic scheduling of when data should be moved. The COTS products that will be used to build this service are:

- Oracle8i RDBMS
- Microsoft's Data Transformation Service
- Oracle8 SQL*Net
- Microsoft's ODBC driver for Oracle
- IBM DB2 Client Application Enabler
- IBM DB2 CLI/ODBC driver

Replication Service

This service provides the ability to replicate the Hub Spatial Database to multiple sites. This service supports the periodic snapshot approach, the transaction level approach and the ability to replicate to sites inside/outside of firewalls over the Internet. The service provides the ability to replicate both portions of tables or complete tables from one site to another. Each site can have complete power over when their version of the Hub is updated. A site can be kept in almost lockstep with a single master site or multiple master sites may be setup so that each master owns a distinct subset of the GIS HUB and shares it with the world when they feel it is fit for publication. The robustness and capabilities of this service are the backbone to the GIS Hub design. This service together with the Hub's data distribution architecture will be keys to

scalability of the GIS Hub rollout. The COTS products that will be used to build this service are Microsoft's Distribution Service and Oracle8i RDBMS.

Data Extraction Service

This service provides the end user with a Web browser desktop interface for extracting data from the GIS Hub into the user's preferred spatial data format. This service has the functionality to support a wide range of spatial formats. The COTS products that will be used to build this service are:

- SAFE FME 2.3
- SAFE ServiceManger 1.0
- ESRI's ArcIms 3.0
- ESRI's SDE 4.0
- Oracle8i RDBMS
- Microsoft's Web Server IIs 4.0
- Microsoft's Internet Explorer 4.0
- GeoNorth's Mapoptixs Web
- Sun's ServletRunner
- Sun's JDK/JRE 1.2
- Sun's JSDK 2.1
- Alliare's Cold Fusion Server 4.0

Recommended Solution

An asynchronous wrapper COM object has been developed around the SAFE ServiceManager (FME Command Generator) to allow users to continue browsing the GIS Hub or issue multiple extraction requests without having to wait for each previous extraction request to finish.

Data Publishing Service

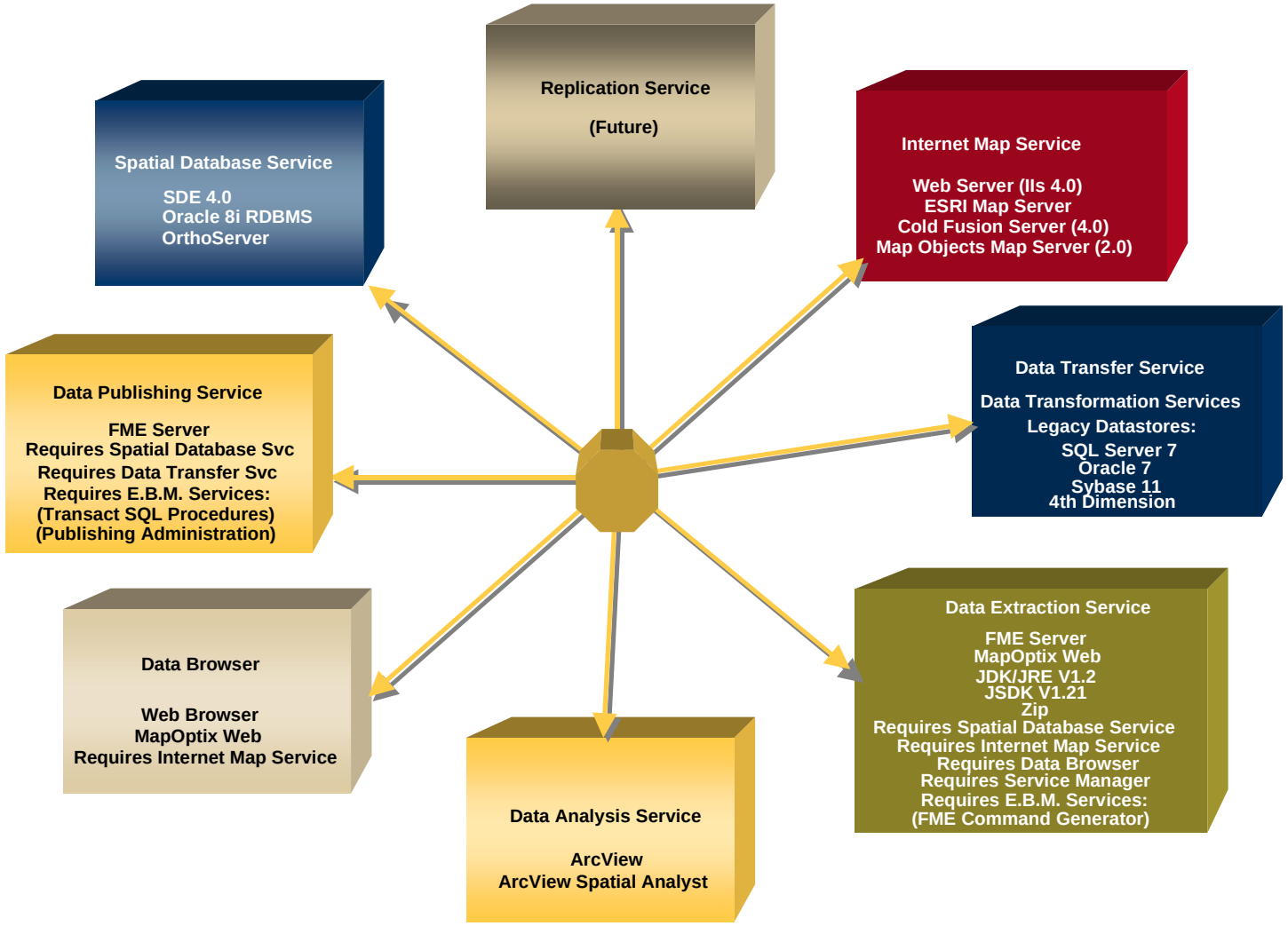
This service provides the system administrator a Visual Basic interface to load partial and complete data sets from MapInfo Mif/Mid, ESRI coverages, Microstation DGN and related Oracle tables. The COTS products that will be used to build this service are:

- SAFE FME 2.3
- ESRI's SDE 4.0
- Visual Basic
- Oracle8i RDBMS
- Microsoft's Data Transformation Service
- Microsoft's Distribution Server

The data publishing service will allow the user to load new data while users use the existing data in the GIS Hub. The system administrator will be allowed to view the data and run some QA/QC checks on the data before distributing it to all GIS Hubs on the network.

Recommended Solution

FIGURE 4-1



Recommended Solution

Client Components

The following services compose the client-side software components. As highlighted in Figure 4-1 on the preceding page, these components are layered on top of COTS products.

Data Browser

This service allows the user to navigate, in a seamless fashion, around the state of North Dakota GIS Hub. Feature based attribute reporting will be supported. The COTS products to be used to develop this service are Microsoft's Internet Explorer 4.0 and GeoNorth's Mapoptixs Web. The design of this service supports multiple categories of users. The design supports the addition of as many user groups deemed necessary by the system administrator. The future rollout of the GIS Hub to public users, to the state's casual users, and to the departments' data maintainers will include this service.

Data Analysis

This service allows the user to perform many common GIS spatial analysis operations. The COTS products to be used to develop this service are ESRI's ArcView 3.2 with spatial extensions and Microsoft's ODBC driver for Oracle8i.

Three-Tiered Architecture

The design of the GIS Hub includes components that form a client-server architecture and other components that form a three-tier architecture. As depicted in Figure 4-2, the three tiers in the GIS Hub design are data servers, application servers, and client

Recommended Solution

desktops. For North Dakota, initial deployment will require two server machines, one running all of the software components that comprise both a data server and an application server and the other running all of the software components that comprise a Web server. The Spatial Database Service, the Replication Service, and the Data Transfer Service will reside on the data server.

The application server will be the middle tier for those running the Mapoptixs Web application on their desktop to perform either generic map queries or data extraction requests. The application servers are, typically, either Web servers or application servers that support the majority of the software components required to perform map serving, data extraction, and data publishing. The Internet Map Service, the Data Extraction Service, the Data Publishing Service, and the Data Analysis Service will reside on the application server.

For those business analysts using the Data Analysis Service on their desktops, the GIS Hub has a client-server architecture. The GIS Hub also has a client-server architecture for the few GIS administrator roles that will exist. For the majority of the GIS Hub users, (the State's casual users, the departmental data maintainers and the general public users) their desktops will serve as the third tier of the GIS Hub.

The desktop currently envisioned for North Dakota, is a Web browser such as Microsoft's Internet Explorer and the proposed State Web portal-based applications for permits, browsing, and extracting. Future portal-based aspatial data maintenance applets may also be added to users desktop.

Recommended Solution

Scalability of the GIS HUB Design

The design of GIS Hub includes some scalability features as highlighted in Figure 4-2. The diagram shows, at each tier, the manner in which the Hub is designed to be scalable.

The data servers are designed so that they can be replicated in as many places as there are physical LANs. This is done to enable natural load balancing of user requests across the data servers. Any server may serve any request. The replication of data servers also reduces the network demands by dividing the load among the LANs within departments and eliminating centralized hotspots or potential bottlenecks.

Server clustering will be supported so multiple nodes within a single server cluster can share the requests addressed to a GIS Hub data server. Server clustering also supports availability by allowing requests to be fulfilled in a degraded mode when one server in the cluster is brought down for maintenance or has a hardware failure.

The middle tier of the GIS Hub system design contains many scalable features, too. The Web server supports the growth in end users requesting a browser connection by using the load balancing of the Cold Fusion Server. It also takes advantage of clustering to scale its CPU power and to support a high degree of availability.

The Cold Fusion load balancing software provides for additional reliability by taking advantage of the fact that Web requests are stateless and resubmitting Web requests to another node in the cluster when a node failure is detected. As the State adds more users to the GIS Hub, the design easily supports the higher demands by simply allowing for the addition of nodes to the Web server cluster.

Recommended Solution

The Web server also supports the load balancing of map requests via the ESRI Map Server. This software component is a DLL added to the Web server component. It supports sending requests and receiving data from multiple ArcIMS instances. So again, as the demand to generate more maps goes up, the design of GIS Hub readily supports this demand either by allowing the addition of more ArcIMS instances to the same application server or by supporting multiple ArcIMS instances on multiple application servers. This can allow the State to grow from supporting 2,000 map requests/hour on a single CPU application server to 10,000 map requests/hour in a multiCPU application server. Again, one could use NT clustering to grow CPU capacity with the additional benefit of higher reliability.

The GIS Hub design supports the growth of data extraction users by using the load balancing capabilities of the FME ServiceManager. A single ServiceManager supports multiple users by queuing their requests. A wrapper around the ServiceManager is being developed to support users not needing to wait for their requests to be serviced. They will be emailed a URL to download the zipped extraction to their desktop. A single ServiceManager can be configured to send the extraction requests to multiple FME engines. A single application server can support multiple FME engine instances. Multiple ServiceManagers could be added to partition up the number of Web servers issuing extraction requests to any single ServiceManager. Multiple FME engines could be added to multiple application servers to support the need for more data extraction horsepower as well. If the state needs to expand their data extraction capabilities, they can start by adding more instances on their existing hardware. They could then add more CPUs to their existing servers. Lastly, the State could expand capabilities by adding more application servers containing multiple FME engine instances.

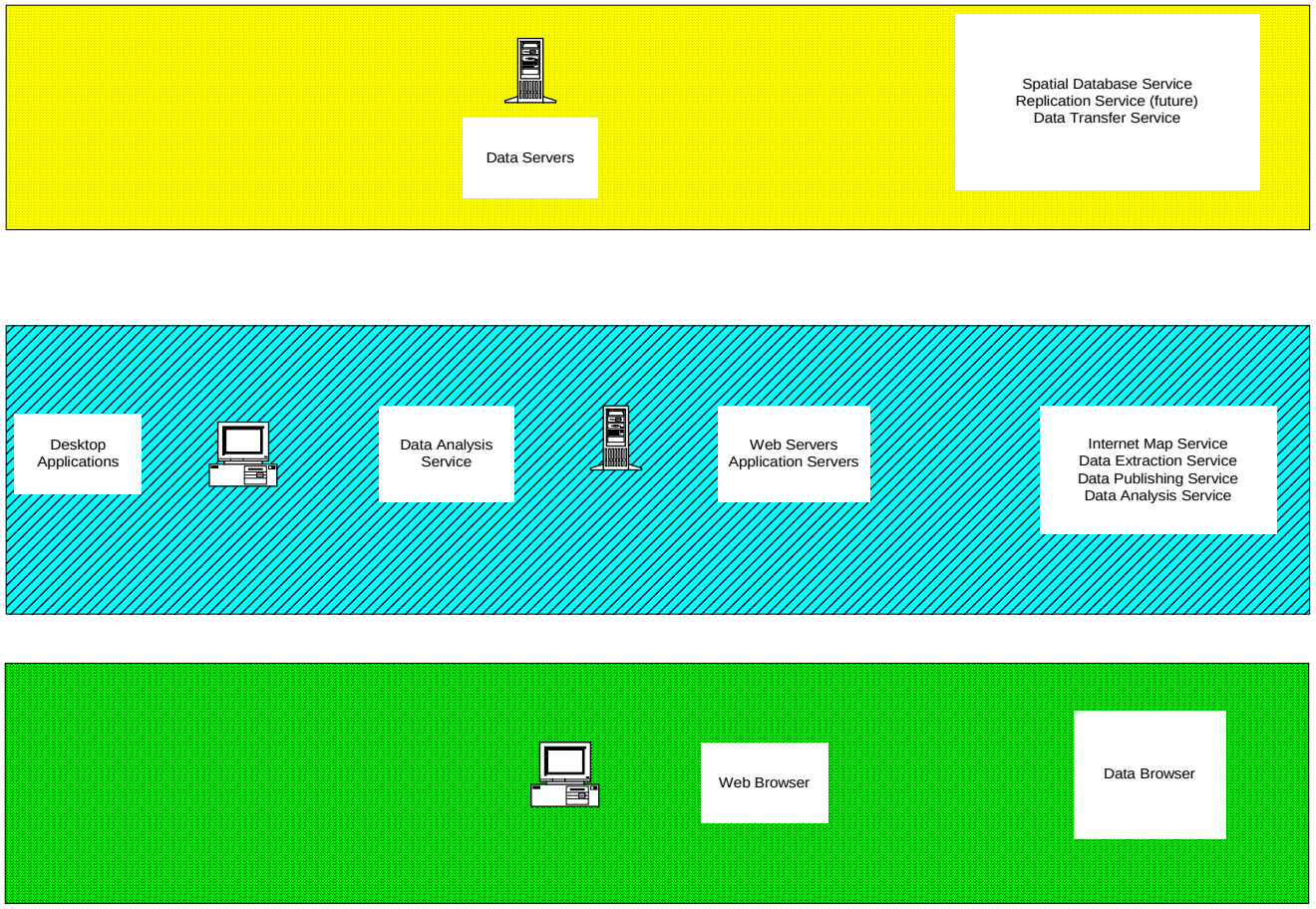
Recommended Solution

It is important to note that there is no scaling for clients running the Data Analysis Service. The current ESRI ArcView software is single threaded, so adding additional CPUs to a client's desktop will not provide any better response.

Recommended Solution

FIGURE 4-2

State of North Dakota Hub
3-Tier Architecture



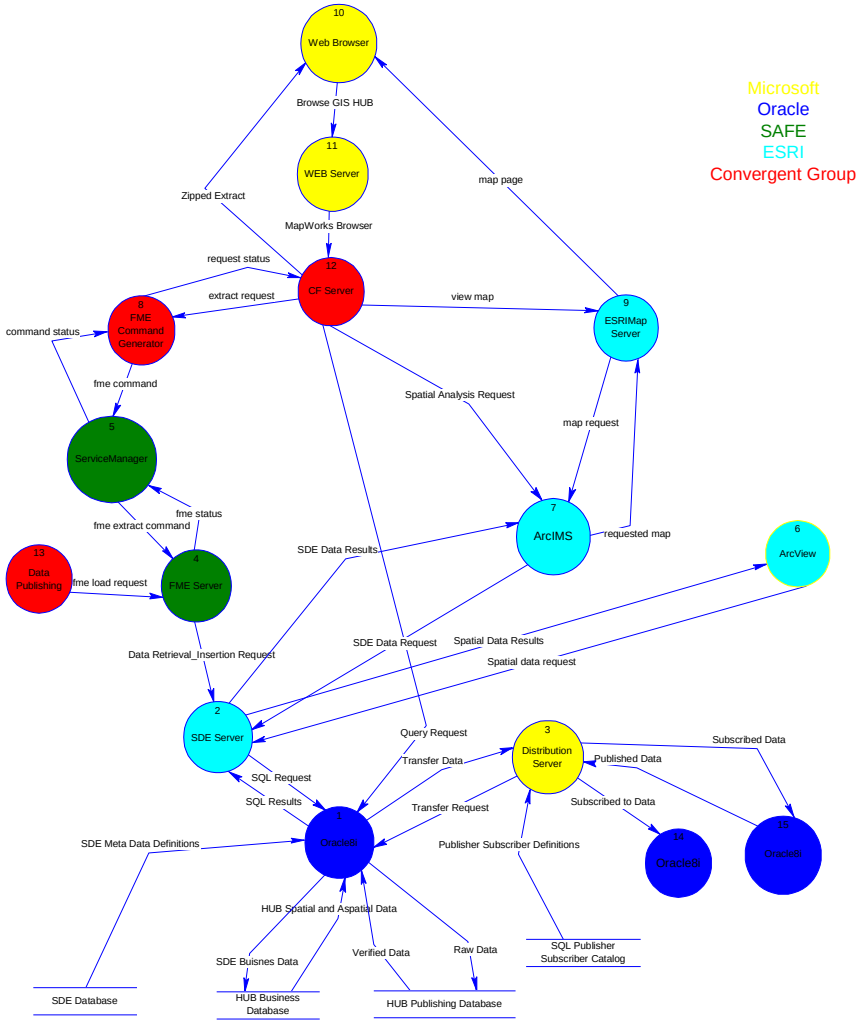
Recommended Solution

HUB Process Integration Architecture

Figure 4-3 on page 4-16, shows all of the software processes that comprise the GIS Hub architecture. The data flows depicts common operational flows. The diagram illustrates the large amount of configuration and integration of software products required to deploy the GIS Hub. Most of the processes on the diagram are highly configurable components that support a wide degree of integration requirements. This diagram illustrates the type of information that flows between the processes.

Recommended Solution

FIGURE 4-3



Recommended Solution

System Architecture Description

The system architecture diagram in Figure 4-4 on page 4-21 depicts where the software components reside. It also shows the three-tier architecture of the design. The scalability and functions performed by the various components have been described in earlier sections. The system architecture indicates which components comprise the various services. The goal of the system architecture diagram is to map the software components onto their respective hardware components.

Data Servers

These machines will hold the Hub databases for initial deployment. They will also hold data maintenance databases as they are developed in the future. The future data maintenance cycle should support users needing to graphically record the changes in their own data maintenance databases. The transactional replication feature of the Replication Service will then move the completed features to one or more copies of the GIS Hub. Data Server machines are good candidates for using NT clustering to support high availability and to maximize the amount of CPU resources available to the users of the system.

The data servers will also be the machines that connect to external RDBMS sources. This provides some physical independence for both the application software and the interactive ad-hoc users.

Recommended Solution

Application Servers

These machines are designed to hold the data analysis service, the data extraction service, the data publishing service and the Active Object Agents. Future vertical analysis applications or other commonly used applications should be added to these servers. The initial deployment will not include these machines. All of their associated services will reside on the data server.

Map Servers

These machines are designed to hold the MapObjects Map Server process. This process receives the map requests from the Web server for processing. Keeping just this work on these nodes allows for tuning of the nodes to support large numbers of map requests per hour with minimal latency. Many instances of the ArcIMS Map Server process may be started on a single node. The initial deployment will not include these machines. All of their associated services will reside on the data server.

Web Servers

These machines will hold the following:

- Microsoft Web Server IIs
- All of the Cold Fusion components
- All of the applications developed with Cold Fusion (Mapoptixs, for the pilot)
- The Sun Java virtual machine required by SAFE (Servlett Runner, JDSK V2.1, JDK/JRE V1.2)

Recommended Solution

- The Microsoft Java Virtual Machine 3.2 required by the FME Command Generator process
- The Xceed zip utility
- The Active Object Broker and Active Client

These machines will primairly handle Web connections and provide the functionality supported by MapOptixs and the FME Command Generator. This functionality includes zipping the results of data extraction requests.

Desktop Applications

These machines are the desktops of the Business Analysts throughout the state. They will hold the Data Analysis Service (ArcView). Any future non Web-based SDE client tools should be allocated to these hardware components within the Hub architecture. The other desktop component shown in the System Architecture diagram is a Web browser. These will be part of the causal user and public counter desktops when the Hub gets rolled out.

Non HUB Components

Data Maintenance

During the interview process, various state agencies indicates that most of them are in need of developing data maintenance applications in order to insure that the State's GIS Hub contains useful, accurate, timely information. It would be premature to suggest an architecture for each of the state's departments but a reference has been

Recommended Solution

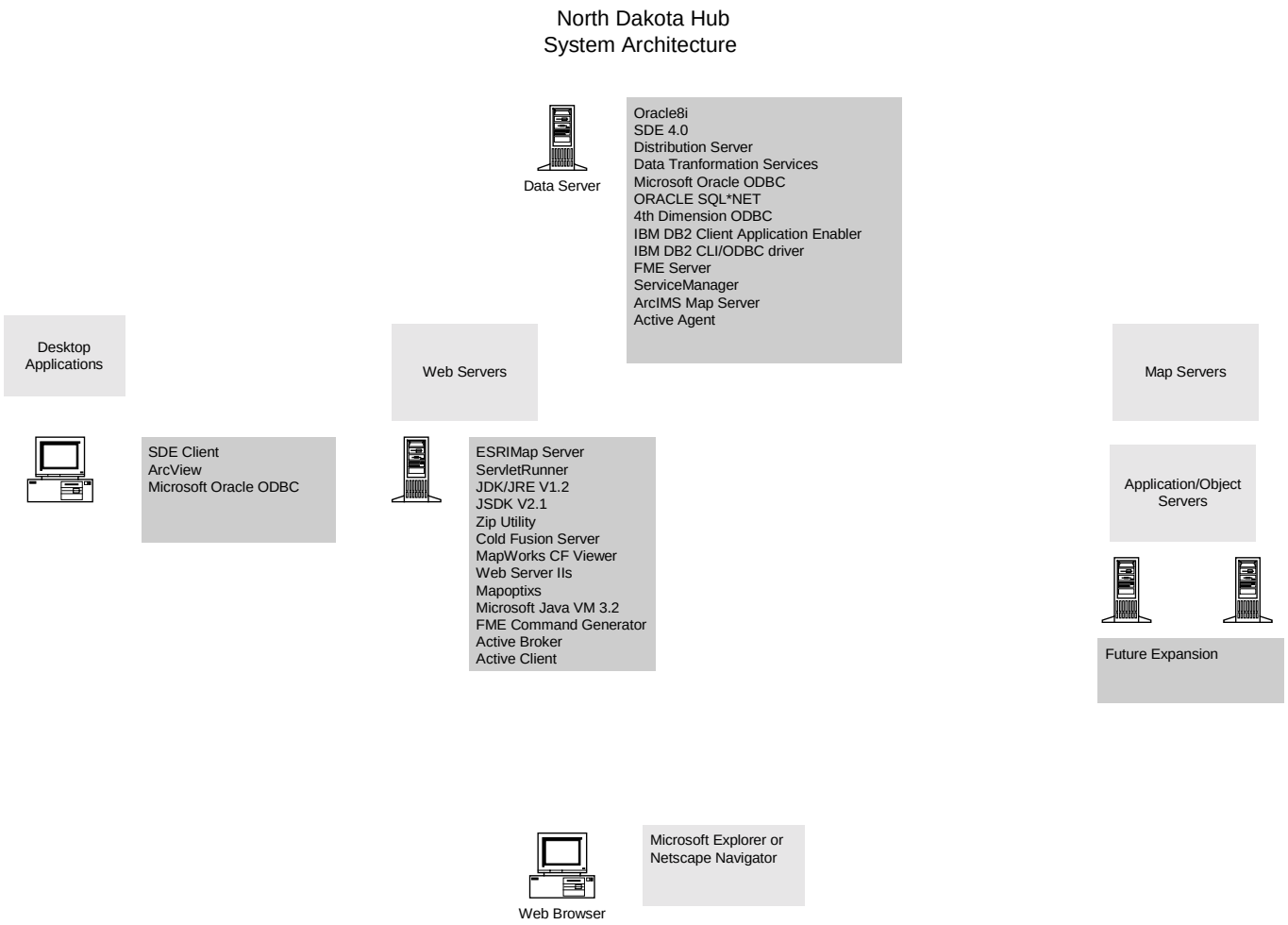
included in the architecture section to ensure that these upgrades are part of the initial GIS Hub deployment plan.

Portal Applications

This component will provide a unified data access application for Internet users to access all of the State's services, data, and on-line applications. To support future growth and ease of maintenance, Convergent Group recommends that the Active middleware package be used in the development of the portal applications. It has three components: Agent, Broker, and Client. The Broker and Client will initially be hosted on the Web Server. The Agent will be hosted on the Data Server. As the system grows, the natural location for the Agent (or sets of agents) will be on the Application Servers.

Recommended Solution

FIGURE 4-4



Implementation Strategy

This section of the report provides a high-level plan for the development and implementation of a GIS Integrated Services Model at the State of North Dakota. This plan includes a description of solution components, budgetary cost estimates, and a high-level implementation schedule.

SOLUTION COMPONENTS

Convergent Group has identified the following components for inclusion within the State's enterprise GIS initiative:

- Enterprise GIS Hub and GIS Hub applications
- State Economic Development Application
- State ISP Opportunity
- State Call Center (Customer Relationship Management)
- State Internet Portal
- Departmental Data Maintenance Applications
- Asset Inventory Management Applications/ASP Opportunity
- E.B.M. System Implementation/Integration Services
- Future Applications (TBD)
- GIS Program Manager

- GIS Database Administrator
- Technical Procurement Model

Each of these components is described in the paragraphs that follow. Not all components will be implemented initially. Some components have much higher priorities than others do. Some components are dependent upon the implementation of other components. These priorities and dependencies are reflected in the phasing of these components described below. Priorities and dependencies will also be reflected in the high-level implementation schedule to follow.

Phase 1: Basic GIS Integrated Services Model

Enterprise GIS Hub and GIS Hub Applications

This component refers to the development and implementation of a centralized GIS data repository and associated applications. The Hub itself serves as the centralized data repository. The Hub uses modern, open systems technology to provide a scalable platform for future system growth. The associated applications provide the ability for users to publish data to and extract data from the enterprise GIS Hub.

State Internet Portal

This component refers to the development of a State of North Dakota Internet Portal. The portal provides Internet World Wide Web gateway to state services and resources. The portal also provides the state with a highly functional online presence, provides

Implementation Strategy

users with 24X7 access to government and provides an online interface to the other solutions components described herein.

Departmental Data Maintenance Applications

Departmental data maintenance applications are department-specific GIS tools that will provide state agencies with the ability to accurately and efficiently maintain departmental data. These tools will help ensure that data published to the GIS Hub is of high quality.

EBM System Implementation/Integration Services

This component refers to the Engineer, Build, and Management system implementation activities and services that will be required throughout the development and implementation of the State of North Dakota enterprise GIS program. EBM services will begin in Phase One and carry throughout the GIS program implementation.

GIS Program Manager

The GIS Program Manager is an ITD resource who will provide program coordination and management services in support of the GIS Integrated Services Model.

Implementation Strategy

Database Administrator: Shared from ITD

A Database Administrator role will be required to support the State's enterprise GIS program. However, as implementation gets underway during the first phase of the program, this need not be a full-time resource. It is likely that this role can be filled using an existing ITD resource on a part-time basis through Phase One of the program.

Technical Procurement Model Implemented

The technical procurement model refers to a set of processes and procedures that will enable coordination of GIS software and service procurement. It is recommended that this model be implemented in conjunction with the implementation of the GIS Program Manager role. This is a no cost item that has the potential to deliver high return in terms of cost savings and cost avoidance.

Phase 2: Enhanced GIS Integrated Services Model

State Call Center (Customer Relationship Management)

This component refers to the development and implementation of a system to support a statewide call center. The call center will provide citizens/customers with a central point of contact for doing business with the state. The type of system envisioned will provide Customer Relationship Management (CRM) functionality to track and manage calls, call status, and call resolution/follow-up. The type of system envisioned provides

citizens/customers with a central point of contact for doing business with the State. The system tracks calls, status, and resolution/follow-up.

Consistent with the State's desire to enhance on-line services to its constituents, the system, as envisioned, will provide support for blended media contact. That is, the CRM system will support and manage contacts through phone, fax, email, Web, or walk in.

Asset Inventory Management/ASP Opportunity

This component leverages the common asset management requirements of several state agencies and provides the State with the opportunity to serve as an application service provider to local agencies. A potential scenario involves development of Internet-based asset inventory management applications for DOT. DOT would then be able to provide local agencies (city, county, and township road and highway depts.) with fee-based (subscription) access to these same applications. Applications and data would reside on State hardware. Local agency data would be maintained by the appropriate local agencies. This component can be structured as a state service and a source of revenue. There is great potential to expand this component into other asset management areas (including Parks & Recreation, State University System, and State Facility Management among others). For scheduling and cost estimating purposes, Convergent Group used the DOT scenario described above. This in no way inhibits the ability to expand this component to other agencies. Convergent Group anticipates that the State will realize greater benefits and a higher return on investment as this component expands.

Implementation Strategy

State Economic Development Application

This component involves design and development of a State of North Dakota Economic Development GIS application. This application provides the capability to showcase potential development sites and identify available resources in an effort to attract new and grow existing businesses. It provides Internet Web-based tools for locating and evaluating potential commercial and industrial sites based on a number of criteria including access to transportation (rail, air, highway), access to utilities, local workforce characteristics, and demographics, among others.

Full Time Database Administrator

As phase one implementation completes the need for database administration support will dictate the need for a full-time resource. This resource will be primarily responsible for performing database administration in support of the Enterprise GIS Hub.

GIS Analyst

A GIS Analyst role will provide ITD with the knowledge, skills, and technical expertise to serve the needs of a variety of departments. This resource can be leveraged to perform many functions that have traditionally burdened departmental resources. This resource will support consolidation of smaller departmental endeavors into ITD.

Enhanced Analytical Applications

This component refers to the development of applications that will support standard analytical functional requirements of a variety of departments. These applications will take advantage of the increased functionality and availability of data provided by the Enterprise GIS Hub.

Consolidation of Smaller GIS Departmental Endeavors Into ITD

As GIS knowledge and skills grow within ITD, there will be opportunities to leverage this expertise to support the smaller GIS departmental endeavors. This component will provide efficiencies in terms of resource utilization.

Phase 3: Leading GIS Integrated Services Model

State ISP Opportunity (North Dakota.Net) Through Chamber of Commerce

This component provides the State of North Dakota with the ability to serve as an Internet Service Provider. The State will have the ability to provide customers with access to State-branded Internet service. Customers can include any citizen or agency or may be limited to just governmental or quasi-governmental agencies (for example, state agencies, local governmental agencies - cities, counties, townships, special districts, school districts, and agencies involved in the state's higher education system). Convergent Group has identified this opportunity as a potential means for generating revenue to support GIS initiatives. GIS and related technologies will likely provide a majority of the content that will be accessed through a State Internet Web

Portal. It is expected that the level of services to be provided and the content to be served through the State Portal will drive customers to subscribe to State-branded Internet service. A variety of strategies and options are possible within the realm of this component. For scheduling and cost estimating purposes, Convergent Group chose to be conservative in terms of defining the degree functionality and services to be provided as part of this component. This in no way limits the ability to expand this component, as needed, in the future.

Shared Services with County and Municipal Governments

This component allows the State the ability to investigate the idea of leveraging its technology resources to provide GIS services to counties and municipalities.

Future Applications (TBD)

This component is intended to serve as a placeholder for the identification and development of future applications. Examples of these include demographic data analysis and land use analysis. Though no estimate has been developed for these types of applications, Convergent Group believes it is important to reference these as future activities within the schedule.

COST ESTIMATE

The following tables (Table 5-1, 5-2, 5-3) provide budgetary cost estimates, by phase, for the solution components listed above.

Implementation Strategy

TABLE 5-1 PHASE ONE SOLUTION COMPONENT COST ESTIMATE

GIS Integrated Services Model Components	Cost Category	ITD	Depts	Contracted Services	Line Item Total	Component Total	Phase Total
Phase 1: Basic GIS Integrated Services Model							
Enterprise GIS Hub and Applications	HW	50,000			50,000		
	SW	55,000			55,000		
	Data				0		
	Labor	55,000		300,000	355,000		
						460,000	
State Internet Portal	HW				0		
	SW	150,000			150,000		
	Data				0		
	Labor	14,400		96,000	110,400		
						260,400	
Departmental Data Maintenance Applications	HW				0		
	SW	90,000	135,000		225,000		
	Data				0		
	Labor	14,400	21,600	48,000	84,000		
						309,000	
GIS Program Manager	HW				0		
	SW				0		
	Data				0		
	Labor	65,800			65,800		
						65,800	
Expert Consulting Services	HW				0		
	SW				0		
	Data				0		
	Labor			110,000	110,000		
						110,000	
Database Administrator (1/2)	HW				0		
	SW				0		
	Data				0		
	Labor	28,200			28,200		
						28,200	
Training	HW				0		
	SW				0		
	Data				0		
	Labor	8,600	12,900		21,500		
						21,500	
Phase 1 Totals by Cost Owner		531,400	169,500	554,000			1,233,400

Implementation Strategy

TABLE 5-2 PHASE TWO SOLUTION COMPONENT COST ESTIMATE

GIS Integrated Services Model Components	Cost Category	ITD	Depts	Contracted Services	Line Item Total	Component Total	Phase Total
Phase 2: Enhanced GIS Integrated Services Model							
State Call Center	HW	50,000			50,000		
	SW	50,000	50,000		100,000		
	Data				0		
	Labor	25,000	20,000	100,000	145,000		
						295,000	
Asset Inventory Mgt/ASP Model	HW	50,000			50,000		
	SW				0		
	Data	100,000	200,000		300,000		
	Labor	25,000	20,000	100,000	145,000		
						495,000	
ED&F Solution	HW				0		
	SW				0		
	Data	100,000	400,000		500,000		
	Labor	20,000	25,000	100,000	145,000		
						645,000	
Database Administrator (1/2)	HW				0		
	SW				0		
	Data				0		
	Labor	28,200			28,200		
						28,200	
GIS Services/Analyst	HW				0		
	SW				0		
	Data				0		
	Labor	50,000			50,000		
						50,000	
New Analytical Applications	HW				0		
	SW	10,000			10,000		
	Data				0		
	Labor	25,000			25,000		
						35,000	
Expert Consulting Services	HW				0		
	SW				0		
	Data				0		
	Labor			215,000	215,000		
						215,000	
Phase 2 Totals by Cost Owner							1,548,200

Implementation Strategy

TABLE 5-3 PHASE THREE SOLUTION COMPONENT COST ESTIMATE

GIS Integrated Services Model Components	Cost Category	ITD	Depts	Contracted Services	Line Item Total	Component Total	Phase Total
Phase 3: Leading GIS Integrated Services Model							
State ISP Model	HW				0		
	SW	15,000			15,000		
	Data				0		
	Labor	50,000		100,000	150,000		
						165,000	
Shared Government Services	HW	Not Estimated			0		
	SW	Not Estimated			0		
	Data	Not Estimated			0		
	Labor	Not Estimated			0		
						0	
Future Applications	HW	Not Estimated			0		
	SW	Not Estimated			0		
	Data	Not Estimated			0		
	Labor	Not Estimated			0		
						0	
Phase 3 Totals by Cost Owner							493,200

As noted previously, Convergent Group does not expect that the State will implement all of these components initially. As indicated by their estimated costs, implementation of all of these components represents no small effort. Several of these components also share certain dependencies with other components. Because of this, Convergent Group believes that it will be most effective to take a programmatic approach to the State's enterprise GIS initiative and structure implementation of the solution components into a series of phases to be completed over a three-year timeframe beginning in 2000. This approach will be reflected in the implementation schedule that follows.

Implementation Strategy

SCHEDULE

Table 5-4 provides a high-level schedule for implementing the various components that will comprise the State of North Dakota Enterprise GIS Program. This schedule is reflective of the various dependencies that exist among certain components of the State's solution.

TABLE 5-4 IMPLEMENTATION SCHEDULE FOR STATE OF NORTH DAKOTA GIS INTEGRATED SERVICES MODEL

GIS Integrated Services Model Implementation Schedule	2000						2001												2002											
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Phase 1																														
Expert Consulting																														
GIS Program Manager																														
Database Administrator																														
GIS Enterprise Hub & Applications																														
State Portal																														
Data Maintenance Applications																														
Assess, Clean, Design																														
Develop Applications																														
Training																														
Phase 2																														
Expert Consulting																														
ED&F Application																														
Design & Data Acquisition																														
Develop & Implement Application																														
Database Administrator																														
GIS Analyst (consolidate over 6 mos.)																														
New Applications																														
Phase 3																														
ISP Opportunity																														

Business Case Details

This section of the report details the findings that support the business case for adoption of an enterprise approach to GIS (in the form of a GIS Integrated Services Model) and implementation of an Enterprise GIS Data Hub for the State of North Dakota. These findings were derived from information gathered primarily during interviews with representatives from the State of North Dakota Information Technology Department and 10 state agencies that are currently pursuing GIS-related initiatives. These agencies include the following:

- Department of Game and Fish
- Department of Parks and Recreation
- Water Commission
- North Dakota State University Transportation Institute
- North Dakota Geological Survey
- Department of Transportation
- Labor Department
- Health Department
- Economic Development and Finance Department
- Aeronautics Commission

Business Case Details

Details concerning the benefits to be achieved through a GIS Integrated Services Model and an Enterprise GIS Hub are organized into the following categories:

- Opportunities for Cost Savings
- Opportunities for Cost Avoidance
- Cost Recovery/Revenue Generating Opportunities
- Subjective/Image Enhancement Opportunities

OPPORTUNITIES FOR COST SAVINGS

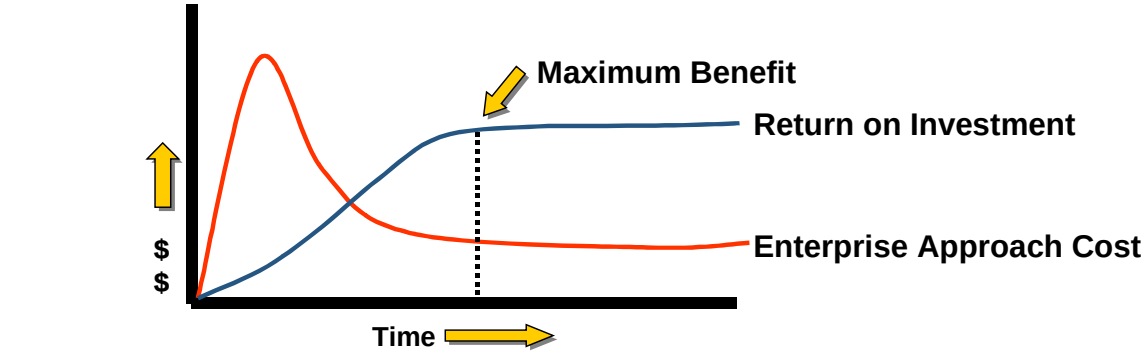
Enterprise GIS will provide the State of North Dakota opportunities for saving costs. Though GIS investment to date has been fairly limited, there are opportunities for realizing cost savings in terms of both expenditures and labor. Though Convergent Group did not capture GIS-related labor information required to quantify specific cost savings, some examples of potential cost savings are provided.

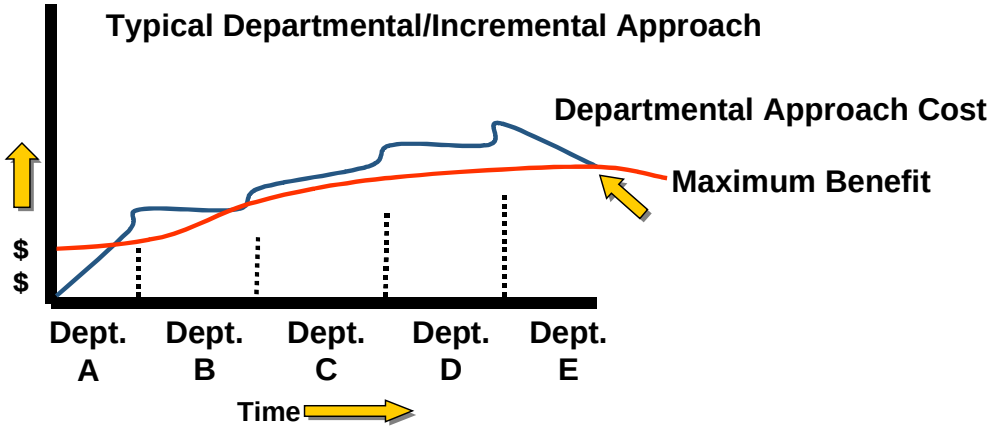
The fact that GIS expenditures have been somewhat limited to date means that now is an excellent time to implement an enterprise GIS approach. Very little of the State's historic investments in GIS technology will be sacrificed in shifting from a departmental approach to an enterprise approach. In contrast, should the State decide not to implement enterprise GIS at this time, it can be assumed that departmental investments will increase in an uncoordinated fashion that, in the future, can only result in a higher overall costs. The following diagram, Figure 6-1 (page 6-3), illustrates how an enterprise approach to GIS implementation offers a increased benefits in a shorter

Business Case Details

timeframe (i.e., quicker payback) when compared to an departmental/incremental approach.

FIGURE 6-1 BENEFITS OF ENTERPRISE APPROACH VS. DEPARTMENTAL/INCREMENTAL APPROACH





Business Case Details

The following points represent opportunities for cost savings afforded through implementation of enterprise GIS.

- Reduced personnel/contractor costs
- Consolidation/coordination of licensed software purchases
- Consolidation/coordination of vendor support and training
- Labor savings associated with creating, compiling, and transforming project data
- Reduced potential for redundant data capture, entry, and storage
- Application standardization and code re-use
- Coordination of application development activities

The following paragraphs provide details concerning each of these points.

Reduced Personnel/Contractor Costs

Nearly all of the agencies interviewed indicated a need for some degree of additional GIS technical expertise, and/or support personnel (including Webmaster support for Internet-based GIS applications and data). None of these agencies indicated a need for (or ability to support) more than a partial FTE.

Should a GIS Integrated Services Model approach be adopted and supported through implementation of an enterprise GIS hub, it is quite feasible that these additional resource needs could be consolidated and served through a centralized support function.

Business Case Details

This support function could operate out of ITD in a manner similar to how other information technology support services are provided, today.

Based on its experience with similar needs in other organizations, Convergent Group believes that certain economies of scale can be achieved through an enterprise GIS approach. Convergent Group believes that, given such an approach, a centralized support function can serve the needs of many agencies using fewer resources than would be required if those agencies were to acquire resources themselves. This can result in cost savings through limiting the need to hire additional internal resources as well as the need to rely on external contractors for support. Table 6-1 on page 6-6 illustrates this concept at a high level.

Business Case Details

TABLE 6-1 GIS SUPPORT RESOURCING: ENTERPRISE VS. DEPARTMENTAL APPROACHES

	Departmental Resource Requirements (FTEs)								Departmental Approach Totals		Enterprise Approach Total	
Resource Type	Game & Fish	Parks & Recreation	Water Commision	NDGS	DOT	Labor	Health	ED&F	FTE Totals	Cost Totals	FTE Totals	Cost Totals
GIS Program Mgr	0.15	0.15	0.25	0.25	0.25	0.1	0.25	0.1	1.5	$86,250	1	$57,500
GIS Technical Support	0.15	0.15	0.25	0.25	0.25	0.1	0.25	0.1	1.5	$77,250	1	$51,500
GIS DBA	0.15	0.15	0.25	0.25	0.25	0.1	0.25	0.1	1.5	$77,250	1	$51,500
Webmaster	0.15	0.15	0.25	0.25	0.25	0.1	0.25	0.1	1.5	$57,750	1	$38,500
Totals FTEs/Costs									6	$298,500	4	$199,000
Savings FTEs/Costs											2	$99,500

Salary Assumptions:	Low	High	Midpoint
GIS Program Manager	$55,000	$60,000	$57,500
GIS Technical Support	$48,000	$55,000	$51,500
GIS DBA	$48,000	$55,000	$51,500
Webmaster	$36,000	$41,000	$38,500

Resource costs assume salaries equal to the midpoints identified above

The potential for cost savings identified here can be further extended to the use of contractors. Many departments currently contract with outside vendors for GIS services and project support. These departments often use the same vendors. An enterprise GIS program approach can be structured in a manner that provides for

centralized coordination of contract services. As in the case of internal resources, economies of scale can also be expected through coordination of contract resources.

Consolidation/coordination of licensed software purchases

While the State does have a purchasing agreement with its primary GIS software vendor, Environmental Systems Research Institute (ESRI), it became evident, throughout user interviews, that not all purchases were being effectively coordinated across user departments. The State purchasing agreement provides for discounted pricing based on the number of licenses ordered at a given time and discounts for licensed software maintenance. In most cases, individual State agencies are only ordering a few licenses at a time. If orders were to be coordinated across multiple departments, the State would be able to leverage volume discounts and realize cost savings.

Furthermore, in cases where departmental GIS software purchases are being made in conjunction with contracts for GIS services, it is questionable as to whether or not the State purchasing agreement is being used to its fullest advantage, if at all.

A programmatic approach to enterprise GIS provides a structure to support coordinated software purchases and leverage purchasing contracts to their fullest advantage. Table 6-2 (page 6-8) illustrates how the State's purchasing agreement can be leveraged to provide the cost savings benefits explained above. Tables 6-3 (page 6-9) and 6-4 (page 6-11) illustrate how these savings benefits can affect the State's GIS implementation budget.

Business Case Details

TABLE 6-2 COST SAVINGS AFFORDED THROUGH COORDINATED PURCHASING

GIS Licensed Software Component	GIS Licensed Software Cost per Unit			GIS Software Savings per Unit	
	Single Unit Purchase	Volume Purchase (6-25 Units)	Volume Purchase (26-50 Units)	Savings per Unit (6-25 Units)	Savings per Unit (26-50 Units)
ESRI ArcView GIS	$956	$861	$765	$95	$191
ESRI ArcView 3D Analyst	$2,246	$2,121	$1,871	$125	$375
ESRI ArcView Spatial Analyst	$2,246	$2,121	$1,871	$125	$375
ESRI ArcView Image Analyst	$2,246	$2,121	$1,871	$125	$375

GIS Software Maintenance Components	Primary License Maintenance Cost	Secondary License Maintenance Cost	Maintenance Savings per License
ESRI ArcINFO	$3,000	$1,200	$1,800
ESRI COGO	$500	$200	$300
ESRI GRID	$500	$200	$300

Note:

For North Dakota, volume discounts apply only to ArcView and related products per state purchase agreement

Volume discounts for ArcInfo and related products are assumed to have been incorporated into single unit license costs

GIS Software support is provided only to the primary license holder

Secondary license holders must coordinate support through the primary license holder

One primary license is required for every nine secondary licenses

Secondary licenses receive no additional documentation or media

Business Case Details

TABLE 6-3 EXAMPLE OF COORDINATED MAINTENANCE AGREEMENT PURCHASES

Departmental Approach	Primary License Maintenance Cost	Secondary License Maintenance Cost	Number of Primary Licenses Required	Number of Secondary Licences Required	Annual Software Maintenance Cost
DOT	3000	1200	1	2	5400
Water Commission	3000	1200	1	2	5400
NDGS	3000	1200	1	2	5400
Total					16200
Coordinated Approach					
DOT, Water Commission, NDGS	3000	1200	1	8	12600
Savings					3600

Table 6-3 provides an example of how implementation of coordinated purchasing, supported through a technical procurement model, can provide savings in annual maintenance costs for licensed GIS software (ESRI's ArcInfo, in this case).

This example is based on the idea that the State's purchase agreement with ESRI includes a discounted maintenance cost for secondary ArcInfo software licenses. If the three agencies (DOT, Water Commission, and NDGS), used in this example, were to individually acquire annual maintenance agreements for three ArcInfo licenses, the resultant cost would equal $16,200. Each agency would have to designate one license as a primary license and two as secondary licenses for a total of three primary licenses and six secondary licenses.

Should these same agencies work in coordination to acquire annual maintenance agreements for all nine licenses, only one license would be designated as primary

Business Case Details

while the remaining eight could be designated as secondary. This would result in savings of $3,600 per year. This type of savings is an example of what a minimum degree of coordination might offer. Savings become more substantial as license numbers increase.

Table 6-4 (page 6-11) provides an example of the cost savings to be realized through coordinated software license purchases. For this example, it is assumed that each of the eleven agencies interviewed will purchase an average of two new ESRI ArcView licenses.

If each of these departments were to individually purchase two ArcView licenses the total cost to the State of North Dakota would equal $21,032

If, instead, all of these departments were to take advantage of the volume discounts built into its agreement with ESRI and purchase these licenses in a coordinated effort the total cost to the State of North Dakota would equal $18,942. The resultant savings from this coordinated effort would equal $2,090. Further, if the State were to go ahead and purchase four additional licenses for a total of 26, it could take advantage of the next tier in volume discount to realize a savings of $1,142 and would receive an additional four license to distribute as appropriate.

As with the example illustrated in Table 6-3 (page 6-9), this example illustrates the effects of minimal coordination effort. Depending on the technical procurement strategies employed and the number of licenses to be acquired, the benefits of coordinated purchasing could be significantly more substantial.

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TABLE 6-4 EXAMPLE OF COORDINATED LICENSED SOFTWARE PURCHASES

Departmental Approach

Department	Single Unit License Cost	Number of Licenses Required	Cost
ITD	956	2	1912
Game & Fish	956	2	1912
Parks & Recreation	956	2	1912
Water Commission	956	2	1912
NDSU	956	2	1912
NDGS	956	2	1912
DOT	956	2	1912
Labor	956	2	1912
Health	956	2	1912
ED&F	956	2	1912
Aeronautics	956	2	1912
Total		22	21032

Coordinated Approach

Coordinated Purchase of ArcView Licenses	Volume Purchase Price	Total Number of Licenses Required	Total Cost
22 Licenses (all depts.)	861	22	18942
Savings			2090
26 Licenses (all depts.)	765	26	19890
Savings			1142

Consolidation/coordination of vendor support and training

The cost of training was a concern expressed by most departments. Coordination of vendor support and training provides cost savings benefits similar to those offered through coordinated software purchases. Economies of scale can be realized in terms of sending employees to vendor training or in the ability to provide training in-house.

During departmental interviews, it became apparent that several interviewees are unaware of the opportunities available for obtaining technical support. This results in additional, unnecessary labor costs associated to project delays while staff attempts to solve problems without support.

In addition to vendor support, there are other support mechanisms available to GIS users. Web sites and newsgroups exist to provide answers to technical questions and offer opportunities to learn how similar agencies are taking advantage of GIS technologies. Some interviewees were aware of these; others were not. An enterprise GIS program can be structured to provide a support role to leverage vendor support, offer alternatives to vendor support, and serve as an internal knowledge base or clearinghouse.

Labor savings associated with creating, compiling, and transforming project data

Due to the variety of functions performed by the various agencies involved in this study it is not surprising that a significant amount of time is being spent creating compiling and transforming data into formats useful for supporting project needs. Users

interviewed indicated that this type of up-front work can as take much as two to five days per project.

In addition to providing for centralized storage of data, an Enterprise GIS Data Hub provides the technology to support the storage of data in standardized formats. It also provides for easy extraction and posting of data. Together, these functions have the ability to significantly decrease the up-front time users are currently spending to prepare project data.

Considering the number of projects undertaken per year, the number of departments that are currently involved in GIS initiatives, and the up-front data cleanup time currently required, it is not difficult to see the cost savings benefits that can be achieved.

Reduced potential for redundant data capture, entry, and storage

Because multiple GIS initiatives are currently underway in many state agencies, data redundancies do exist. These redundancies result in labor inefficiencies related to the capture and entry of data as well as inefficiencies associated with the storage of redundant data. A GIS Integrated Services Model supported by an Enterprise GIS Data Hub provides the technology to greatly reduce data redundancies and, therefore, provide a certain degree of cost savings.

Business Case Details

Application standardization and code re-use

In Convergent Group's experience, enterprise approaches to managing and implementing GIS technologies provide increased opportunities for cost savings related to application development over departmental approaches. An enterprise approach provides the means for identifying common application requirements that support development of standard, enterprise GIS applications and re-usable application code. Standardization of application and code re-use can provide significant cost savings, not only in application development, but also in application support and enhancement.

Coordination of application development activities

Even where standardized applications are not totally feasible, coordination of application development activities can provide significant cost savings benefits. This is possible because business processes often cut horizontally across the departments within an enterprise. In Convergent Group's experience many vertically aligned applications can be leveraged to support business needs that cut horizontally across an enterprise.

An example of this can be seen in an asset management application. The State Parks and Recreation department has expressed a need for an asset management application. Asset management can satisfy the business needs of several state agencies in addition to Parks and Recreation. By taking a coordinated, enterprise wide development approach versus multiple, individual approaches, significant cost savings can be realized.

OPPORTUNITIES FOR COST AVOIDANCE

In addition to saving costs, an enterprise GIS also offers the State opportunities to avoid costs. Most potential cost avoidance opportunities are similar to cost savings opportunities in that they are realized by eliminating redundant investment and leveraging GIS infrastructure and skills across the enterprise. While potential avoided costs are typically quantifiable after-the-fact, they still provide a compelling case for implementing an enterprise GIS.

The following points represent opportunities for cost avoidance:

- Reduce project mobilization costs
- Ability to leverage skills, training, and learning curves across multiple departments
- Elimination of application development and data redundancies
- Application development/platform re-use opportunities

Details concerning each of these points are provided in the following paragraphs.

Reduce project mobilization costs

As explained in the previous section, there are certain cost savings benefits that can be achieved through an integrated, enterprise wide approach to GIS implementation. This idea can be extended further in that, as new and/or existing GIS users expand

Business Case Details

current initiatives and undertake new initiatives, certain startup and development costs can be avoided by leveraging existing data models, core datasets, enterprise applications, application development standards, and reusable application code.

Ability to leverage skills, training, and learning curves across multiple departments

The ability to leverage skills, training, and learning curves across multiple departments through coordination of efforts and establishment of centralized resources and knowledge bases will help the State realize some degree of cost avoidance. Potential avoided costs include reduced need for contractors, additional staff training, and project latency.

Elimination of application development and data redundancies

Convergent Group has found that multiple, uncoordinated departmental GIS initiatives tend to produce application and data redundancies. This also results in the types of labor inefficiencies described earlier. A GIS Integrated Services Program will provide technology, data, and staff resources to new initiatives, thereby reducing redundant or unnecessary investment.

Application development/platform re-use opportunities

An Enterprise GIS Data Hub provides a platform and standard technologies to help facilitate re-use. Re-use opportunities can be leveraged through a coordinated enterprise GIS program to provide significant cost avoidance benefits.

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COST RECOVERY/REVENUE GENERATING OPPORTUNITIES

Cost recovery and revenue generating opportunities may well represent the most compelling arguments for implementation of enterprise GIS. Funding of GIS initiatives is always a concern. An enterprise GIS program can be developed in a manner that supports coordinated cost recovery and revenue generation activities.

The following points represent opportunities for cost savings afforded through implementation of enterprise GIS:

- Enterprise program approach provides structure to support management of program costs
- Enterprise applications may be further leveraged in providing services to external agencies
- Opportunity for State to become an Internet Service Provider (ISP)
- State-sponsored Internet "portal" can be leveraged to provide additional revenue opportunities

The following paragraphs provide detailed information for each of these points.

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Enterprise program approach provides structure to support management of program costs

An enterprise approach to GIS provides a structure to support tracking of program costs. This ability to track costs across the enterprise, helps provide a more complete picture of the GIS program and provides a basis for identifying potential cost recovery and/or revenue generation opportunities. In a departmentally focused approach, GIS costs can occur under multiple line items within many departmental budgets. While an enterprise GIS program may not completely eliminate this, it does provide easier methods for identification of the majority of GIS-related costs. The ability to identify costs helps support and even justify efforts to recover costs and/or generate revenue.

Coordination of cost recovery and revenue generating efforts through an enterprise program approach also helps to ensure that these efforts are applied consistently across the enterprise.

Enterprise applications may be further leveraged in providing services to external agencies

As noted earlier, an enterprise program can support the ability to leverage certain GIS-related applications for the benefit of multiple agencies across the enterprise. This concept can be expanded further using the earlier example of leveraging the functionality of a proposed asset management application to support the requirements of multiple departments.

A significant number of external agencies have asset management requirements that are very similar to those of local governmental agencies. Should the State take an

Business Case Details

enterprise approach to developing asset management applications for its own use, it should not require a much larger effort to leverage these applications or generate revenue by selling services to the various local governmental agencies within North Dakota that require similar functionality.

If a Web-based strategy is used to develop asset management tools for state agencies, it could be argued that a fairly logical next step might be for the State to serve as an application service provider (ASP) in enabling local governmental agencies to access these tools.

In an ASP model, the State would host local agency data and provide access to its applications for a monthly fee. The State would then be responsible for the hardware and software components involved in providing the application service as well as application support, database management/administration, backup, and recovery services. Local agencies would be responsible for owning and maintaining their own data.

Opportunity for State of North Dakota to become an Internet Service Provider (ISP)

In working with the State to develop this plan, Convergent Group has proposed the idea that the State could become an Internet Service Provider (ISP). While there are a multitude of issues and details that surround this concept, the goal would be to provide a new stream of revenue to support development of enterprise GIS and electronic governance technologies.

Business Case Details

GIS technology provides a significant amount of the back office technology, data, and applications that support electronic governance initiatives. Among its clients, Convergent Group often finds that enterprise GIS and electronic governance initiatives are very closely tied together. The idea that GIS and related technologies serve as large functional components of electronic governance initiatives provides a significant argument for implementation of an enterprise approach to GIS implementation. The idea that the State could provide Internet services is one method for generating revenue to support enterprise GIS and electronic governance initiatives.

Because there are a multitude of issues surrounding the ISP issue, strategies can vary significantly. For example, if the State does not wish to provide ISP services to individual citizens, it could potentially limit service provision to state agencies, state universities, and local governmental agencies.

Because multiple strategies are possible, it is difficult to quantify the amount of revenue that can be generated through this opportunity. Depending on the specific strategy employed and the number of subscribers involved, the State could potentially bring in revenues of between $1 and $5 per subscriber, per month, for as long as it wished to provide ISP services. Additional revenue opportunities exist related to development of a State Internet “Portal” as described below. Table 6-5 illustrates the revenues that can be expected based on a given number of potential subscribers and an assumed profit margin of $3 per subscriber. For this example, Convergent Group has estimated ISP startup costs to be approximately $160,000. The red and black numbers help illustrate the point at which payback of these startup costs can be expected.

TABLE 6-5 POTENTIAL ISP OPPORTUNITY REVENUES

Months / Users Payback Table											
Gross Margin:	**Budget:**										
$3.00	**$160,000**										
	Months										
Users	5	6	7	8	9	10	11	12	13	14	15
2500	$37,500	$45,000	$52,500	$60,000	$67,500	$75,000	$82,500	$90,000	$97,500	$105,000	$112,500
5000	$75,000	$90,000	$105,000	$120,000	$135,000	$150,000	**$165,000**	**$180,000**	**$195,000**	**$210,000**	**$225,000**
7500	$112,500	$135,000	$157,500	**$180,000**	**$202,500**	**$225,000**	**$247,500**	**$270,000**	**$292,500**	**$315,000**	**$337,500**
10000	$150,000	**$180,000**	**$210,000**	**$240,000**	**$270,000**	**$300,000**	**$330,000**	**$360,000**	**$390,000**	**$420,000**	**$450,000**
12500	**$187,500**	**$225,000**	**$262,500**	**$300,000**	**$337,500**	**$375,000**	**$412,500**	**$450,000**	**$487,500**	**$525,000**	**$562,500**
15000	**$225,000**	**$270,000**	**$315,000**	**$360,000**	**$405,000**	**$450,000**	**$495,000**	**$540,000**	**$585,000**	**$630,000**	**$675,000**
17500	**$262,500**	**$315,000**	**$367,500**	**$420,000**	**$472,500**	**$525,000**	**$577,500**	**$630,000**	**$682,500**	**$735,000**	**$787,500**
20000	**$300,000**	**$360,000**	**$420,000**	**$480,000**	**$540,000**	**$600,000**	**$660,000**	**$720,000**	**$780,000**	**$840,000**	**$900,000**
22500	**$337,500**	**$405,000**	**$472,500**	**$540,000**	**$607,500**	**$675,000**	**$742,500**	**$810,000**	**$877,500**	**$945,000**	**$1,012,500**
25000	**$375,000**	**$450,000**	**$525,000**	**$600,000**	**$675,000**	**$750,000**	**$825,000**	**$900,000**	**$975,000**	**$1,050,000**	**$1,125,000**

State-sponsored Internet portal can be leveraged to provide additional revenue opportunities

A state-sponsored Internet portal can provide a common point of access to the State's Internet presence and serve the front-end tool for displaying the content provided by back-end systems like GIS. This portal also provides other opportunities that may be leveraged to generate revenue. These opportunities include:

Business Case Details

- Advertising revenues
- Online permitting and licensing (including online payment)
- Point of Access to Application Service Provider functions (e.g., Asset Management Applications)
- Point of Sale for GIS maps and related data

IMAGE ENHANCEMENT OPPORTUNITIES

Though considerably more subjective, opportunities related to enhancing the State's image are similar to cost recovery and revenue generating opportunities in that they represent some of the more compelling arguments for adopting an enterprise approach to implementing GIS and related technologies. Convergent Group often finds that the benefits that may be gained through these types of opportunities are more attractive to clients than many of the hard dollar cost savings or avoidance benefits identified.

The following points represent image enhancement and other subjective opportunities afforded through implementation of enterprise GIS:

- Economic Development applications
- Enhanced ability to provide maps and data to the public
- Compliance with federally imposed mandates or self-imposed regulations/requirements

Business Case Details

The following paragraphs provide details concerning each of these points.

Economic Development applications

In speaking with the State Economic Development and Finance Department, it was noted that North Dakota is attempting to grow and diversify its economic base through the attraction of new businesses. A key component of this strategy is the development of an Internet-based Economic Development application. The application, as currently envisioned, would provide users with the location of available commercial and industrial properties and information concerning the type and location of services available. The ability to provide community profiles and local labor pool statistics is also desired.

While there are benefits to be achieved in helping drive businesses to potential relocation sites within the State, development of this type of application also has great potential to further the State's image as a technology-astute place to do business. This means, however, that the data required to support this application needs to be timely and accurate.

Much of the information this application is expected to provide can be described as spatial. As such, the need to provide access to a variety of spatial (and aspatial) data lends support to the need for enterprise-level coordination that can be provided through an enterprise GIS program supported by the technology infrastructure provided by an enterprise GIS data hub.

Business Case Details

Enhanced ability to provide maps and data to the public

The ability to provide maps and data to the public offers much in terms of opportunities to enhance the State's public image. Proactive publishing of information can also provide a side benefit of reducing requests for some datasets. An Enterprise GIS Hub provides the technology and tools to support regular publishing of a variety key datasets.

Compliance with federally imposed mandates or self-imposed regulations/requirements

Compliance with a variety of regulations and requirements helps to establish a positive image for the State. For example, compliance with the requirements dictated by the recently issued General Accounting Standards Board Statement 34 (GASB 34) can help the State maintain or even increase its current bond rating. The asset management examples provided previously illustrate how an Enterprise GIS Program can support such compliance.

Business Case Details

THE COSTS OF NOT IMPLEMENTING AN ENTERPRISE GIS PROGRAM

An alternate way of looking at the benefits of implementing an Enterprise GIS Program is to examine the costs of not implementing such a program. Without a coordinated, Enterprise GIS, state departments will pursue GIS initiatives independently. These efforts will result in redundant and possibly incompatible systems. A reactive, fragmented approach to GIS will impede the State's ability to integrate operations and limit the value of information as an enterprise resource.

If the State does not take a proactive, enterprise approach to GIS implementation, it will not realize the most significant benefits of the technology. There will be no platform to support any of the following initiatives:

- The State Economic Development application
- Call Center/Customer Relationship Management
- The State Portal

Moreover, there will be no technology platform to support any degree of coordinated program administration or management. This will contribute to ongoing waste in procurement of GIS technology, applications, data, and services.

Continued investment in departmental GIS "silos" will cause the rate of divergence and redundancy found within these efforts to increase exponentially -- multiplying the cost and business impacts should any decision to coordinate efforts be made in the future.

Appendix A

INTERVIEW NOTES

Jerel Bulke
North Dakota State Game and Fish
(701) 328-6303

Round One:

1. Use very little GIS today
2. Arc View – 2-3 copies for scanning line contour maps for public
3. New project for GPS/Game management
4. Utilizes third party contractor for data/support source (Jackson, Ketter and Lee)
5. No GIS in field office
6. Building and maintaining Habitat Model: Lone Tree management area; GIS and population models; UNIX; working with Bureau of Reclamation
7. Novell and Win 95
8. Want: temporary GIS position; field staff and biologist support; wildlife management and environmental assessment needs: Forecasts 25 users
9. They are not sure if they want to be in map business: non-residents look for maps
10. Inexperienced staff with respect to GIS
11. Borrow data today

Appendix A

12. Currently less than optimum management of weeds, crop rotations, and fertilization
13. GIS for office mostly, not field
14. Data needs: aerial, IR, time series
15. Revenue: licensing and permitting: just put on Web site to sell licenses: wants ITD to take over maintenance; too many local legacy solutions
16. Currently paying $600/700 month for Internet access. Too high! E-mail over modem
17. Prefer having a centralized service provider of GIS applications/reports/data
18. May need data access from six regional offices
19. Less than 1,000 square miles managed (Revalidate this number)
20. GIS is low on the Game and Fish expenditure list and priorities.

Appendix A

Round Two:

- Wildlife Management areas are “top shelf” priorities
- Interested in vegetative mapping (correlate w/ species occurrences)–expect to be able to use federal data
- Public Land Initiative–KLJ developing overlays using ArcInfo–NDG&F thinks they could do themselves

- Lots of interest in GIS at state level – nobody dedicating resources
  - State contract with ESRI (purchasing)
  - Purchases go through specific set of channels (purchasing dept.)
  - Nobody using ESRI training credits?
  - Would like to coordinate GIS purchases rather than individual purchasing– need to establish set of ground rules for this

- County boundaries serve as map base for manual maps
  - Management and enforcement districts based on county boundaries
  - Inconsistent use of county boundaries within department (multiple versions of county boundaries in use)

- Building Web site for issuing hunting/fishing licenses (testing phase)
  - Transactions processed through Bank of ND
  - License data provides key contact information

    - Name
    - Phone number
    - Address
    - Type of license
  - Inquiry system for license lottery
- Hunting/fishing infractions kept in different system

- Web licensing application built by third party - looking to move away from 3rd party support to ITD support
  - Data model issues exist related to separation of data – multiple values exist in single field
  - Would require some rework prior to production release

- Web presence also includes:
  - Species distribution maps on Web
  - Lake contour maps – generalized (could be dressed up with roads, etc.)

- Internet access expensive ($16 per device – including shared printers + $300/month for 56k line)
  - Going through local ISP w/dialup
  - $25/month access fees
  - Using WinProxy
- State provides faster speeds

Appendix A

- Not necessarily interested in doing business in field offices

- Other products for public w/GIS base
  - Wildlife distribution maps – state outlines w/ game areas
    - Delineated high, medium, low populations
- Drainages would be good information for big game management

- Issue: Grad students work of projects for state – where does data go when students leave?

- Issue: Presentation maps done by individuals – no real central storage of this information

- Issue: Quality of data (other than inconsistent use of county boundaries) is more an issue of accuracy than detail

- Surveys performed annually – game population (wildlife management)
  - Spring population
  - Reproductive surveys

- Broken down by management district

Appendix A

- Management district boundaries dictated by biologist in charge of species management

- Survey areas/routes broken down to county level for flexibility

- Big game management districts generally follow highways
  - Delineated by basins (James River, Missouri River)

- Fisheries data – tied to a specific lake
  - Set of codes for each Lake
  - Data coded by location within each lake for bigger lakes
  - Standardized coding/data gathering practices in place
  - Location codes by county – but county not as important
  - Data exists mostly in Dbase

- Extensive effort in gathering data, analyzing, processing
  - Periodic, regular rotation of fish studies (every three to five years for most lakes, annually for bigger lakes)
  - Annual bird species studies
  - Periodic big game species studies (as conditions permit – requires snow)
    - Mule deer studies performed annually in spring (after snowmelt)
    - Annual big game harvest studies – questionnaires (currently hardcopy mailings - could be done over the web – savings in mailing costs)

Appendix A

- Number of days hunted
- Number of animals killed

- Other data sources that might be of value
  - Fish and wildlife service – wetlands information
  - Crop and livestock reporting data vs. wildlife surveys
    - Correlate reproductive data vs. crop data
  - Soil surveys
  - Water quality data
  - Looking at getting federal data
    - BLM – ESRI data
    - Dept. of Agriculture – ESRI data

- GIS for studies/planning
  - Look at study area conditions
  - Access to study areas

- Rural mail carrier survey – currently collected from hardcopy worksheets
  - Good backup/fallback data source – not a primary data source
  - Lists county, miles driven, number of critters identified

- Existing software/database applications include Dbase, SAS, Crystal Reports

Appendix A

Round Two (Continued):

- Area of Interests:
  - Wildlife management
  - Hunting Units

- Surveys are field collections via GPS

- Base map Information
  - Native habitat overlays with USDS and Department of Forestry
  - Using sections, counties, maps
  - Smallest boundary areas: counties

  - Other Data Layers
    - Habitat
    - Ground cover
    - Vegetation
    - Crop & livestock
    - Landsat
    - Vegetation overlays
    - Water Quality
    - Lake Contours
    - Road network

- Currently in testing phase of placing permits on Web.
- Looking to get Web access to two or three large point of sales outfits: K-Mart, WalMart, etc…
- Currently have delays because of all entry being done centralized
- Potential exists to integrate with enforcement and licensing

- Current infrastructure has some proxy limitations

- Tracking high, medium, low populations of game
- Game and fish exhibits
- Survey routes are rural mail carriers

- Game Warden oversees county boundaries
- Basic Management Boundaries: ad-hoc polygons hand drawn on maps
- Big game management based on drainages

- Survey Frequencies:
    - Annually - game
    - Harvest time
    - Annually - Larger lakes
    - Annually - Bird
    - Annually - Big Game

- Annually - Mule Deer
- Rotating years - Moose

- State biologists in charge of species management
- Hunting maps are basins subdivided into hunting units
- Lots of survey points for: test netting: durations, size, locations, species
- DBase use extensively for point survey information. Use SAS for statistical analysis
- Use of aerial photos today
- Need good repeatable source for other data sets
- Use rural mail carriers to generate survey information four times a year
- HIP – Federal Program for migratory birds
  Today's cost is $1.50 per person but would like to see Web drive down cost to $0.20 per person
- Has some IVR integration, calls roll to call center

Appendix A

- Sees value in vegetation collaboration with heritage and non-game species and game managers

- Has some need for editing.

Appendix A

Jeff Quast
North Dakota Parks & Recreation
(701) 328-5379

Round One:

1. Jeff is the only computer person in Parks & Rec
2. Are no GIS people in P&R
3. Jeff is doing some GIS: natural plan communities
4. Arc View – 1 workstation (Win95, Pentium 166mhz, 2GB) with plotter and scanner
5. Get data from third party via CD-Rom (Ameritech Engineering), natural plan occurrences, bio-conservation database. Good working relationship with Ameritech
6. Support environmental impact analysis
7. Where wants to go? Facilities management (huge infrastructure of buildings, roads etc) $28M in facilities with 45 employees. Need maintenance management/care
8. Today, maintenance and weed control applications (65K records) of unknown accuracy, data currency = 30-95 days
9. Current problems: inaccurate data, not keeping up with maintenance, manual and haphazard data maintenance
10. Can't support GIS by themselves: need central dedicated resource
11. The database and owner is at the Park, not at state building
    - Report published annually

Appendix A

- New records manually added on paper
- End of year manual merge
- Republish

12. Asset data now in Dbase; moving to Oracle, should be complete by mid-year
13. Had been budgeting $65K/year: based on input from Ameritech Engineering, for GIS next year and for acquiring data
14. Annual budget is a 90 percent cap of previous year (note: this is same concept for all departments)
15. Receives Federal Grant of $30K to boost the GIS program
16. Mobile computing is needed/must: believes there are transmission issues
17. $40k this year for hardware replacement within department
18. Training and skills are a problem for GIS within the department (time, money, travel)
19. Predicts 15 users: 1 per park with 5 in planning/HQ
20. Today: travel costs are high.. not using database for predictive maintenance
21. Revenue via permits for cabins/kiosks reservations
    - Third party reservation contract: billing done via same third party
    - 3.5-4k reservations average/year
    - $5/reservation is fee to third party
    - long distance costs are large
22. Wants to sell reservations and annual passes over Internet
23. Currently has own Webmaster (FrontPage 2000)
24. External customers are asking for Internet access @ parks

Round Two:

- Applications:
  - Natural Heritage Rare Species and Significant Natural Community Distribution Maps
    - Based on Biological Conservation database
    - Over 4000 records (30-45 fields/record)
  - Environmental Review – use ArcView to compose comments and map known locations of rare species and significant natural communities within and around project areas
  - Conservation planning and facilitation – countywide, watershed, or ecoregional levels
  - Site specific mapping – State Park Natural Resource Management – land types, management units
    - Management areas within State Parks:
      - Natural Communities – GPS'd these units
      - Will begin using aerial photos

- Data (1:100000):
  - State Boundary
  - County Boundaries
  - Townships, Ranges, Sections – Ameritech made compatible w/1:100000 – broken up by county

-
- Cities and towns
- Hydrology
- Biological Conservation Database

- Data sources:
  - ND Game and Fish - periodically, don't get info all of the time
  - US Fish and Wildlife – provide digital data by species/county (ASCII files)
  - Nature Conservancy – provide digital data by species/county (ASCII files)
  - US Forest Service
  - Northern Prairie
  - Ducks Unlimited – provide digital data by species/county (ASCII files)
  - NDGS created data for recent project

- Needs:
  - User friendly clearinghouse – not so technical. They know info is there. Needs to be easier to access, work with
  - 7.5 minute quad coverage
  - Listing of all available 1:100000 coverages
  - Training – ArcView (intermediate and advanced) and GPS
  - Links to other GIS sites (cooperation/coordination w/ other GIS user agencies)
  - On-line help specific for ArcView users
  -

Appendix A

- No general funding exists for GIS – Kathy finds grants
  - $30,200 grant from DOW Elanco
  - Contracted $7,645 to AmeriTech GIS to develop GIS database for the Heritage Program
  - $22,555 used to purchase hardware and software including GIS workstation, GPS receiver, plotter, scanner, laptops and monitors
  - Not much invested in software
  - GIS software upgrade (ArcView 3.2) - $300
  - Interested in State contract for coordinated purchasing/licensing of software
  - Many items/datasets like aerial photos where initiatives could be better coordinated across state agencies

- Cost recovery:
  - Can charge out-of-state consultants
  - Haven't historically charged for data
    - Legislation required

- Management of Facilities/Assets:
  - Trying to develop Web application to provide access to maintenance and facility records
  - Have CAD drawings of parks

Appendix A

Round Two (continued):

- Use 1:100,000 township, range, section grids.
- Update survey point attributes. Approximate 4K worth of field details
- Works closely with U.S. Fish and Wildlife and U.S. Department of Forestry
- Products
  - Tall grass inventory maps
  - Mixed grass and native prairie
  - Inventory of all native communities
  - Starting to map parks
- Use GPS
- Use ArcView 3.2
- Use flyovers
- Difficult time using current clearinghouse for sources
- Use Data Use Agreements to provide for updates to products

Appendix A

- Review other state projects
- Would like to have facilities management database to include:
    - Inspections
    - History of maintenance
- Using aerial photos as part of base map
- Planning department updates CADD drawings of parks
- Not getting most out of ESRI help desk

Appendix A

Chris Bader
North Dakota Water Commission
(701) 328-4771

Round One:

1. Vision:
   - Fully integrated client server
   - Spatial info managed as attribute data
   - ARC SDE look
   - Need state sponsorship – can't afford at water commission

2. Eighty-two employees but 15 would be users
3. NT 4.0 and Mac OS (65%) for desktop and server; Fourth Dimension database with ~2M records. Likes MicroImage which runs on Mac OS; uses Appletalk and TCP/IP (He understands that sticking with Mac is probably not feasible and knows it is not the "standard" desktop). Believes retraining from MAC to WINDOWS will be an issue
4. MapInfo and ArcView (8 and 10 copies respectively): Does not like Arc View 3.x = "junk"

Appendix A

5. Performs/would like to perform Temporal and 3D analysis on:
   - Garrison Diversion
   - Dams
   - Devil's Lake Flood
   - Water appropriations
   - Ground water
   - Surface water
   - Add climate data

6. Would like to see (highly desirable)
   - ArcSDE with ArcView and ArcInfo at desktop
   - Client server
   - Fourth Dimension applications
   - GIS should be a number one or two priority: believes the State Engineer understands but would not put it at that high of priority

7. Uses models: ground water from USGS: would like to add other commercial models
8. Believes ITD must be the lead role, build infrastructure, resource and maintain, otherwise could miss out on economic development. ITD be the service provider – only way Water can succeed

Appendix A

9. Background:
   - Governor's Exec Order 1995-05
   - Coordination between agencies
   - Not sure Governor really understood the "rest of the iceberg"
   - Sponsored by NDGS (belief). No budget/authority assigned.
   - GIS committee established with Steering Committee of 5 agencies with Direct Authority
   - Water
   - Geo Survey
   - Health
   - Parks & Rec
   - Game & Fish
   - ITD representation
   - Needs an annual report
   - Not sure report has been done in three years
   - Spatial Clearing House was a positive outcome but this has waned

10. Background – Political climate
   - Legislature down on GIS
   - 1970's REA Program (Regional Environmental Assessment Program - REAP)
   - Digitization of sections, range, county
   - Outgrowth of coal industry
   - Digitized boundaries
   - Public Service is custodian of the Data

Appendix A

- Legislature looking to cut dollars
- Move to put more into IT and thus dollars going up
- Strategic plans to be used/focused as opportunities for cutting
- 90-95 percent budget caps bi-annually
- Governor believes in smaller government

11. Believes he should be sharing data with Health Dept (water quality); as well as private consultants and governments
12. Use TIGER/DEG data
13. Budgeted:
    - $100K and three additional staff over next 6 years
    - $120K/staff member per bi-annual
    - ArcInfo to be purchased in 1st bi-annual
    - ArcSDE in 2nd Bi-annual
14. Believes ITD could begin with a data warehouse for the GIS community
15. Less than 10 percent of the data used, is created by Water. Data is mostly point data
16. Fourth Dimension database has been successfully integrated with the WEB
    - Interactive view and/or download
    - Water permits: no filing on-line (security and comfort zone)

Appendix A

Round Two:

- Applications:
  - Water Management
  - Groundwater modeling
  - Surface water modeling
  - Use in-house and Corps of Engineers developed tools
  - HEC RAS
  - Modflow (USGS developed)
  - ArcView
  - MapInfo
  - Looking at MIPS/GRASS (MIPS benefit – binary compatibility across platforms)
  - Have 25 percent of software budget from 10 years ago

- Data:
  - Using more imagery
  - Color infrared – spend approximately $100-200K range biannually
  - Landsat 1m may be useful
  - Soils data
  - Township, Range, Section system in use
  - 1:100K

Appendix A

- Working w/ USGS to finish 30m DEM (fill in w/10M)
- Will be involved w/basin delineation
- Well inventory – all observation wells, test holes (point data w/temporal component)
- Precipitation Db – 900 observers – reported daily/monthly
- Water Permits – point and polygon data – land area tracts assigned for water appropriation
- Dams, drains, wetlands – point data (lat/lon) – can be tied into GIS
- Aquifer delineation – projects published hardcopy
- Hydrology – accurate enough at 1:100k
- Road coverage – accurate enough at 1:100k

- Platform
  - 65-35 percent split w/ Macs vs. Windows
  - Dual platform in some areas
  - Database system – using Fourth Dimension

- Data sources:
  - Exchanging data with Federal sources
  - Involved with EPA grant – wetlands inventory (using MapInfo tools to put into Coverage/Shapefile format)
  - LiDAR – getting info for DEM coverage data (cost share w/ other agencies?)
  - Aerials – flying every three to four years (color infrared)

Appendix A

- Permit applications
  - Maintenance/inspections
  - Annual use data collected - could be gathered on-line
    - Irrigation (over one acre)
    - Municipal/industrial
    - Light manufacturing (if using own water source)
    - Anyone that pumps over 12.5 acre feet is required to obtain permit
    - 100 – 200 permits issued per year (tied to climate and economic trends)

- Typical project characteristics:
  - Project areas aquifer based – static
  - Surface water project areas managed by basin areas
  - Extent of project areas understood/covered
  - Graphic data is standalone, one-off, produced on project by project basis

- Hardware/Network/infrastructure:
  - 10 Mb switched ethernet LAN (30 percent capacity)
  - Servers on CAT 5
  - Departmental Database environment – 4D – installing mirrors (offsite @ ITD for disaster recovery)
  - Ongoing cost for 4D less than $2K per year
  - Tried using field units (HP71 handhelds) – went back to paper

Appendix A

- Interested in revisiting MDT use

- Other:
  - Health Dept. is primary internal customer
  - 200 – 300 aquifers classified
  - Monitor close to 2500 observation wells throughout the year
  - Also have private monitors where insufficient staff exists
  - Water chemistry collected at least once every 10 years per well
  - Highly competitive/stressed areas could be checked up to 3 times per year
  - Water levels monitored weekly, monthly, annually – depending on usage

Round Two (continued):

- Base Maps
  - Township, range, section 1:100K USGS
  - 30M DEMs
  - Imagery
  - Color IR (flyovers)
  - Soil Type

Appendix A

- Using
  - MapInfo
  - ArcView + Spatial Extensions
  - Modflow
  - HEC RAS
- Looking at
  - Grass
  - Mips
- Products
  - Well Inventory
  - Frequency ranges from daily to monthly
- Water Permits use Points, Polygons, and Attributes
- AORs: dams, drains, wetlands
- Base Layers
  - Hydro 1:100K
  - Roads 1:100K

Appendix A

- Sixty-five percent of department uses Macs
- Federal Agencies
  - Wetlands as coverages
  - DEM coverages
- Color IR reflown three to four years. Have 20 years of IR data
- Fourth Dimension used extensively as RDBMS
- Historical construction and maintenance back to 1900
- Nine hundred field personal collect well data monthly
- Projects based on aquifers
- Use NOAA and NCAR climatic data
- LAN is 10MB/switched
- Servers on 100MB
- Installing disk mirroring
- No response time issues to date
- Very low O&M of around $2K/year

Appendix A

- Current field collection is on paper forms.
- Sharing Water Quality with Department of Health
- 2500 monitoring wells
- Using County surveys for soil types

NDSU – Transportation Institute

Denver Tolliver (NDSU - Fargo)
Doug Bensen (NDSU – Fargo)

- Projects/activities:
  - Generate some source data
  - Use other source data
  - Collected/developed themselves:
    - Grain elevator database and report – located w/ lat/lon
    - Developed some facilities inventory data
  - Stated using ArcView for data storage and reporting, visual display
  - Attribute data stored on other database
    - Dbase (aspatial data)
- Data:
  - Most data is current state (not history)
  - Agricultural land use data from Agricultural Dept.
  - Railroad spatial database
  - Current state
  - Abandoned railways denoted
  - Data came from ESRI and Federal RR Administration
  - Currently get pavement management system file from NDDOT

Appendix A

- Other departments on campus get data
- Natural Resource Master's Degree students
- GIS instructor (resigned) was information focal point
- NDSU Geography Dept. is current focal point

- Formats:
  - Primarily ESRI shapefiles
  - TransCAD – translate data between TransCAD and ESRI ArcView
  - No web capability yet
  - Need for web capability discussed for a particular project – may be next phase
  - Clearinghouse info may be useful

- Interaction w/ other agencies:
  - US DOT – Federal Hwy. Admin, Federal RR Administration
  - US Dept. of Agriculture – Agriculture Mkt. Service, Educational Resource Service
  - National RR Association (database only – no GIS yet)
  - National Agricultural Statistical Service
    - Sub-county landuse data
    - NASA satellite images
    - Field data collection

- Other: Have Advanced Traffic Analysis Center - use (Fed.) software for analysis

Appendix A

Round Two:

- Tracking all grain elevators
- Developed accurate railroad network
- Using ArcView, dBase to track facilities, capacities, other attribution
- Current Survey: Agricultural landuse with production strata
- Works with Federal DOT and DOA on Federal Highways and Railroads
  - National Railway
  - AMS
  - Economic Research
- Exchanges data with National Statistical Service
  - Sub County Landuse
  - Satellite and field studies
  - Production Data with Transportation Themes
- Performing Advanced Traffic Analysis
  - Traffic Simulations
  - Data Collection Program

Appendix A

Ryan Waldkirch
North Dakota Geological Survey
(701) 777-2231

Round One:

1. Ryan's background is Cartography and GIS with some remote sensing. Based in Grand Forks
2. ArcInfo: 2 copies (1 NT, 1 Sun/OS)
3. Arc View: 3 copies (mainly for geologists)
4. Not using a Database: everything is in coverages; not too much attribute data
5. Doing soils mapping (DLG)
6. USGS publish maps that NDGS gathers the data (Public Land Survey)
7. Oil/Gas – geophysical data for prediction
8. Bulk of his time: data creation on cartographic output (65-75 percent of time)
9. 5-10 percent answering questions
10. Not enough economic decision making to push for sharing; use of available data , sources, applications, analysis
11. Has one full-time equivalent in Bismarck doing soils concentration
12. Committee is right way to go for participation
13. Customers:
    - Private oil/gas/drilling
    - Private engineering - DRG, Hydro, Roads data
    - Universities

Appendix A

14. Today, does not use DOT data for roads. Purchases it from elsewhere
15. Charges his time at $30/hr for special projects. (this is happenstance and his call as to charge or not)
16. Runs a First order GPS station (Trimble) via subscription service: keep 12 months of data
17. Has part-time Webmaster
18. NDGS: 11 professional staff, 8 support staff
19. Needs to be doing:
    - Analysis (need more done with 1:24000)
    - No standard symbology in NDGS (data standards)
    - Integrate with other Agencies
    - More service to the Public

    Move towards database and store more attribute information

Round Two:

- Create geologic layers (statewide)
  - Formation
  - Type
  - Genesis
  - Descriptive information
  - Mineral resources

Appendix A

- Coal mapping/coal database
  - Whole state complete at 1:500k
  - Going back through at 1:24k (15-20% complete)
- PLSS
  - Township, Range, Section
  - 1:24k
  - Work share w/ USGS
  - Finishing up last 20 quads
  - Collecting section corners
  - Collecting other points along lines (witness points, meander points)
- Soils
  - 1:24k
  - Partner w/Natural Resource Conservation Service
  - 50 percent complete with State – using field sheets, compile onto mylar photos, scan, perform raster to vector conversion, produce as DLG3
  - Vital to state (many taxes based on soil type)
- Topos
  - Paid to have USGS do topos at 1:100k
  - East part of state – 20-30m contour intervals
  - West part of state – 5m contour intervals
- Oil and Gas Pipeline data
  - Repository for collecting pipeline data
- Oil well data

Appendix A

- Location of wells
- Formation
- Some chemical analysis data
- All wells have surveys associated to them – legal descriptions
- Have application to calculate lat/lon from these

- Civil boundaries
  - Canada border
  - Parks
  - Historic
  - Civil townships
  - National Parks/Forests/Scenic Waterways

- Software:
  - Using ArcInfo 8 (1 NT) (1 Sun)
  - ArcView
  - Petris – Oil and Gas software
  - Attribution going into INFO (except oil and gas – going into mainframe)

- State agency interaction:
  - DOT – county maps (on CD) – using to get gravel pit and quarry locations
  - Don't get a lot of data from other State agencies
    - Not a lot exists
    - Unsure as to how state datasets are derived (no metadata)
    - Produce metadata for their coverages (Not FDGC)

Appendix A

- Projections:
  - Federal stuff in UTM
  - Store everything in lat/lon Geographic
    - Prefer Lambert Conical
  - Everyone in state using something different

- Other Data:
  - Have some satellite imaging
    - Don't use a lot
    - Limited use on project by project basis
  - Limited number of DOQs
  - Corps of Engineers flew Missouri River color infrareds
  - Have acted as storehouse for data in past
  - NRCS owns orthos
  - Soil project driving DOQ production

Round Two (continued):

- Geological layers statewide at: 1:24000
    - 1:1Meter
    - 1:500 feet
- Tracking: genesis, formations, area, linear

Appendix A

- Soil data: Mineral, pot ash, coal, tinker
  - Working with USGS filling in SURGO field sheets
  - Product: 1:24000 with natural resources
- Public Land: Township, Range, Sections
- Oil Wells: location, formations, production, chemistry, surveys
- Oil & Gas: Pipeline safety, field collection effort
- Civil Boundaries based on 7 ½ minute quads:
  - Parks
  - Townships
  - National Parks, Forrests, Managed lands
  - Military
  - Indian
- Wildlife
- Coal
- 1:100000 contours statewide. Some 5, 20 and 30

Appendix A

- Using ArcInfo, ArcView on NT and Suns
- Attribution in INFO
- State IT Department houses Oil &GAS survey attribution in Oracle
- Other Agency Data
  - ND DOT County Maps: gravel and quarries
  - NRCS Orthos
- Base maps in Lat,Long and UTM
- Using two Lambert zones
- Some satellite via grants for small projects
- Missouri River done with color IR

North Dakota Department of Labor
Mark Bachmier
(701) 328-3708

- Mapping program data
- Database apps used to store program data
- Complaint data
- Against employers (related to labor standards)
- Unpaid wages
- Discrimination
- Sexual harassment
- Housing discrimination
- Source of complaints (location/concentration)
- Try to be proactive to prevent violations
- Target compliance education programs to areas of highest complaint concentration
- Would like to map complaint and non-compliance sources
- Overlay compliance education
- Track where they speak
- How many times
- How many people spoke to

Appendix A

- Software environment:
  - Running Access in NT environment
  - Off of LAN server
  - Windows NT Workstations
  - Access application developed by vendor
    - Wage claim database
    - Equal employment database
  - Smaller apps developed in house
    - Youth employment
      - Map where youths employed within state
      - Chart types of work performed by youths
  - Have been playing with ArcView
    - Got some data from clearinghouse in Fargo (NDGS)
    - $1k/copy cost not scary
- Potential time component (trend analysis)
- Percent change over time
- Trends – relationship between compliance education and quantity of complaints (direct correlation)

Appendix A

- Increase/decrease in complaints over time by area of state

- Not much historic data
  - Wage and hour info – 10 years of data
  - Equal employment – 5 years of data

- Data sources/reference materials:
  - Labor market information (ND Job Service)
  - Census data

- Web complaint submittal is possibility

- Forms currently available over the web – download, print, complete, mail

- Complaints often require many accompanying submittals
  - Demand letters
  - Check stubs
  - Time cards, etc.
  - Memos
  - Policy manuals

- Interested in developing areas on agency web page to display statistics

Appendix A

- Developed their own departmental web site

- Single user/standalone apps (only one or two copies)

- No IT people involved in support of web site

- Other applications:
  - Licensing of employment agencies
    - Requires submittal of application
    - Proof of bond
    - $200 fee

Round Two (continued):

- Enforcement of claims
  - Housing discrimination
  - Employment

- All point data

- Visual aids/exhibits to legislators

- Assessment frequencies

Appendix A

- Education frequencies
- Incidents categorized by non-compliance
- GIS apps overlay educational programs against populations and dollars
  - Number of claims vs number of presentations vs number of compliance education classes
  - Youth Employment
  - Wage Claims
  - Housing Applications
- Data sets:
  - City, county, municipal boundaries
  - Major towns
  - Labor market information
  - Census data
- Could make use of simple WEB access to internal/external data sets and internal attributes
- Good example of a floating license user

Appendix A

Dave Glatt (and others)
North Dakota Health Department
(701) 328-5217

Round One:

1. Been doing GIS for seven years
   - source water protection
   - layering of quad maps
   - One ArcInfo workstation; eight ArcView Licenses
   - Four to five real users
   - Win/NT

2. Want to tie in all Environmental Data bases from within Health
   - Next 6-12 months
   - Maybe use for general health for epidemiological (some GIS, early stages)
   - Web access from intranet only (security and legal issues)

3. State has a contract with ESRI
4. Data is point source within 25 meters: ~50GB total data (all types)
5. Projected users = 50
6. USGS data on Web site
7. Skill retention/hire is a problem: need more trained resources
8. ITD is not involved in Health-GIS. Health has own expertise
9. Health grants water permits – the only application on the internet

10. Four year replacement cycle in their planning
11. Budget = $15K for GIS to include maintenance (ArcInfo)
12. They believe a Demo to the legislature would be highly useful:
13. Where to save/look:
    - Small group maintaining coverages
    - Not central DB (too much churn)
    - Shareable equipment – plotters, scanners
    - Air Quality man need real time and/or field support

14. US EPA = 80 percent of funds; plus General Funds and small amount from Fees
15. $500k - $1M in hardcopy map/data that is not maintained and thus re-purchased periodically

Round Two:

- Most of their data is GPS point data
  - Water quality sampling points
  - Discharge points
  - Field crews collect
  - Updated on project by project basis from twice/year up to once every 5 years

- Member of GPS Steering Committee
  - GPS base station @ Bismarck College

Appendix A

- Data provided on Internet – password protected
- NDGS runs this (10-15 paying users)

- Data Sources:
  - DOT
  - USGS
  - National Wetlands Inventory from US Fish and Wildlife
  - Image data from Ag Stats (whole state, updated yearly, 30 meter accuracy)
  - Aquifer maps from Water Comm.
  - State Technical committee purchased Images & Orthos

- Hardware/Infrastructure
- 100 Mb LAN internally
- 10 Mb LAN to rest of State Departments

- Other:
  - Data stored in Access and Oracle
  - Looking at electronic submittal of consultant data
  - Looking at tying together all databases
  - They do get electronic sample data
  - Looking at new Lab Information System to tie together:
    - Microbiology
    - Chemistry (currently has a LIM)

Appendix A

- Forensics
- Provide data to consultants (Excel, TAB, ASCII, Arc Info export files
  - 5 Gig of GIS coverages on FTP site
  - Some shapefile data
  - Some hardcopy data
- Drinking water program data available through web

- GIS Use:
- Using core GIS functionality
- Db front end apps
- Don't do a lot of analytical creation of data from other datasets
- Disease Control doing lots of thematic mapping (zip code based)
- Health staff wrote AMLs to clip DRGs, convert to grids
- Convert everything to geographic coordinates

- Issues:
- Conversion of datums becoming problematic (GRS 80, NAD83, some stuff in NAD27)
- Pushing for Geographic as common projection – easy to project, transform as necessary
- DOT using UTM 14 for whole state
- Lots of reinventing the wheel when creating, reprojecting data

Appendix A

- Some issues w/ point data on wrong side of road, creek, etc. – not major concern – most maps produced as visual display only

- Would like:
- Soils mapping
- Intergrated 911 information (addressing and what facilities are located at each address)
- Need 14 digit Hydrologic Unit Codes (HUC)

Round Two (continued):

- Base Map Needs:
  - USGS
  - ND DOT
  - ND Game and Fish
  - USF&W
  - EPA
  - Road boundaries
  - DEMs/contours for whole state

- GPS survey points with attribution

Appendix A

- Other Data Sets
  - REACH File Index
  - Streams
  - Aquifer Maps
  - Environmental
  - National Statistical Services Landuse
  - Flood Plains
  - EVAC
  - Wetlands
  - Would like to have access to all state generated data sets

- Need better quality of orthos

- Use both Oracle and Access for attribution collected via surveys
- Using ArcView and ArcInfo, some AML, Avenue programs

- NPDS – track solid waste, radiation, UIC, storage clients, EPA, Air Quality

- Can charge for Air Quality

- Nice to haves:
  - Tie together existing environmental data sources
  - Automate physical sampling with laboratory

Appendix A

- Integration with LIMS

- 911 Addresses used to generate facilities locations

- Disease control overlaid on Census data by zip codes

Doug Faiman
North Dakota Dept. of Transportation
(701) 328-2561

Round One:

1. 1995 Governor formed the GIS committee (Exec Order 1995-05): This committee became a technical committee as opposed to a business committee
2. 1998 ISD became ITD and now responsible for standards/policies: Doug asked for State wide GIS plan. This got into state plan but no money
3. DOT is responsible for county line maps
4. DOT and State Patrol started the Mobile Data Terminal program: This expanded to a statewide communication plan: within three years MDT accomplished for State Patrol. DOT maintains equipment and Towers
5. Looking for momentum and visibility
6. GIS is a hard sell: (Doug believes we should change name and focus differently)
7. May be some resistance from long time DOT founders to sharing data and/or joint participation
8. All the maps for DOT are digitized. Still some applications to be built
9. Differing Grid Systems: Game and Fish zones not same as DOT
10. Arc Info = 5
11. Arc View = 50
12. NT and Win95

Doug is concerned about executive alignment. He believes, but not sure on others.

Appendix A

Round Two:

- Projection - Universal Transverse Mercator (UTM)
  Zone - 14 extended to include all of North Dakota
  Units - Meters
  Datum - North American Datum 1983
  Precision - Double
  Source Scale - Scale varies as indicated with coverage information below. It should be noted that the overall purpose of the base map data was to reproduce the county base maps at a scale of 1:126,720 (½" = 1 mile) and city base maps at a scale of 1:12,000.

- Current Data Sets:

  I. State Coverages

  A. State Transportation
  State Highway System
  Ramps
  Reference Points
  Highway Numbers
  Railroads

  B. Boundary Information
  County

Corporate
District
Legislative
Miscellaneous
Mountainous
State
Park
Wildlife
Waterfowl

C. State Miscellaneous
ND City Points
Utility

VI. County Coverages
A. County Transportation
Bridges
County Routes
Railroad Crossing Points
Road Miscellaneous
Traffic Count Stations

B. County Hydrology
Water Area

Water Line

C. Public Land Survey
Section
Township

D. County Miscellaneous
Cartography
Cultural Points
Cultural Miscellaneous
Gravel Pit Locations
NGS Stations
Accident Node Numbers

- Attribution entered by districts into DB2 database for road inspections, conditions, maintenance details.
- Contains ND road inventory and current projects
- Yearly update cycle from counties via redlines.
- Concern over traffic accident accurracies. Looking into using GPS for accident reports.

Appendix A

- Currently scan in accident sketches.
- Use ESRI Route database structure, so may not move to an SDE 4.0 implementation.

Appendix A

Department of Agriculture

- Using ArcView and Access to manage bee hives.
- GPS locations and field survey attributes.

Appendix A

Corey Finneman
Loreta Gilbert
North Dakota Economic Development and Finance
(701) 328-5328 (Corey)

Round One:

1. Economic Development and Finance falls under Business and Labor committee in the Legislature.
2. Primary Sector: Manufacturing, Food Processing, Information Services Technology. These are perceived as the areas of 'new wealth' for the state. IT is the main target.
3. "Growing North Dakota" 1991 program to invest and grow the state - took a 1999 budget hit of $1.5M and 6 FTE: now 22 FTE and $9M bi-annual budget: Community development was worst hit.

4. Key backbone of North Dakota revenue: Federal Gov't, Agriculture, Energy.
5. State Bank of North Dakota is allowed to make a profit.
6. Thinking of creating a Commerce Department and consolidating agencies.
7. ED&F Priorities:
   - Take on Manufacturing Growth (includes IT development/industry)
   - Will host data and extract public info for publication (Web)
   - Want to sell North Dakota

Appendix A

- Web site: market the state. Trying to "Brand" themselves. Contracting with local provider (Kadrmas, Lee and Jackson)
- Web site would include: GIS applications; information and knowledge management, extra-net, ISP to service/data host

8. Kadrmas, Lee and Jackson: third party GIS and Engineering: doing a pilot; they are taking a lead in the state on data and ortho
   - Pilot Phase 1: State portray
   - Pilot Phase 2: Available properties and proximity factors
   - Pilot Phase 3: Manufacturing pricing data, State maps and drill down on attributes
   - Pilot Phase 4: Community Profiles

9. North Dakota is modeling is ED&F and GIS program after State of South Carolina
10. Need to utilize Univ North Dakota resources (Grand Forks) since should already have GIS resources
11. Data sharing has not occurred in the past; Major obstacle to ED&F plans/mission. Need DOT and ROW and weight data.
12. ITD should take the lead
13. New Governor is seated in January, via fall election
14. ArcView usage
15. Works with 36 professional developers

Appendix A

Round Two:

- Potential Economic Development Application
  - South Carolina – leading state as far as research in economic development (Dept. of Commerce)
  - ND has more limited scope
  - Working on pilot project w/ KLJ
  - Want to build on GIS platform
    - Display State infrastructure data
    - Display data on available industrial and commercial properties
    - Show table w/query results
    - Show visual results of query in GIS
      - Infrastructure layer
      - Transportation layer

- Ongoing project - Community profiles (including data concerning labor force, level of education)
  - Short term – general profiles
  - Long term – comprehensive profiles

- Want to Web-enable a lot of datasets
  - Community/state profile datasets

- Datasets maintained by developers in field (local Economic Development Agencies)
- Other state agency databases
- ED&F datasets

- ED&F Databases:
  - Access (moving to SQL Server?)
  - VB front ends
  - May or may not be web front ends

- ED&F has a role in 80 percent of state agencies
- Just started marketing idea of ED & F Web application
  - Reaction generally favorable
  - For benefit of entire state

- Interaction with other agencies:
  - Key alliance with Job Service of ND
    - Statistical warehouse
    - Have been able to acquire staff and resources
    - More than just state
  - Higher Education
    - Degree offerings
    - Course offerings

Appendix A

    - Graduation statistics
    - Market available labor
  - DOT
  - Water Commission

- Business Attraction Efforts:
  - IT industry is number one target in terms of business attraction efforts
    - Software development
    - Software services (e-commerce)
    - Telecommunications
    - Call Centres
    - Export Services (technology companies w/ out of state markets)
  - Other targets
    - Food processing
    - Industrial and construction equipment manufacturing
    - Electronics manufacturing
  - Agriculture was “the” industry for years
    - This would have left State in crisis in past years if not for Econ. Dev. Efforts
    - Agriculture no longer “primary” industry
    - Diversification has lessened impacts
    - Targeted marketing is key
    - Still a long way to go

Appendix A

- Issues/Concerns/Comments:
  - Data accuracy is big concerns – especially in providing Internet access to local developer agencies
    - No real-time entry at first
    - Validate with staff
  - Planning, creation, implementation will require large resource allocations
    - Expect efficiencies once implemented
    - Primary goal is creating a better product
    - Leads to investment in State
    - Create a greater standard of living – better jobs
    - Better utilization of resources
  - Investment required for pilot project – budget dollars available

- Other
  - One person at ED&F has GIS training
  - Maintaining ESRI ArcView license updates
  - No delineated budget item

Appendix A

North Dakota Department of Aeronautics
Mark Holzer
(701) 328-9650

- Using GIS for Airport Master Planning
  - Expansion of existing airports
  - Relocation of facilities

- Areas of concern center around individual communities (+ five mile radius)
- GIS for airport site selection
  - Airspace zoning areas around airports

- Pavement analysis of 71 airports w/ paved runways (occurs every three to five years)
  - Aerial photos scanned into ArcView
  - Indicate pavement condition by color
  - Use six different colors (overlay on aerial photo base)
  - Model/forecast decline of pavement
  - Data supports master planning efforts
  - KLJ performs GIS work
  - Subcontract pavement inspection and condition rating to Eckrosee & Green (Wisconsin)

  - Data loaded into GIS

- Have 93 airports in GIS (includes those w/ grass runways)
- Produce Aerial Airport Directory booklet for pilots
- DOT flies photography
- Martinez (vendor) scans photography
- Civil Air Patrol provides photos, too (not aerial photos) (taken out of window of aircraft to show what airport looks like on approach)
- ND Aeronautics provides DOT with airport coordinates
- Could also provide photos to DOT for use in roadway planning
- Use USGS quad maps on occasion
- New photography flown as changes occur (approx. every two to four years)
- New directory produced every two years
- Have Aerial images on Web site
- AirNav database on Web
  - Provides length of runways
  - Lists services available at airports
- ITD provides webmaster/support to ND Aeronautics
- Best use of GIS for them is in public meetings

Appendix A

- Also use to prepare EIS as part of master planning
  - Airspace zones
  - Noise patterns
  - Wetlands
  - Roads

- Funding:
  - Use Aviation Fuel Tax monies to fund program
  - Fargo, Bismarck, Minot, Grand Forks get their own monies
  - NDAC manages funds for all other airports in State
    - Force accounts – bill Feds for time spent
  - Plan development costs:
    - $30-50k/project for small airports
    - $100-300k/project for large airports

- Other Duties:
  - Register Agricultural Sprayers (only 200)
    - Hardcopy registration forms
    - $200 fee
    - not interested e-commerce approach due to small number of registrations and idea that they'd lose 2.5 percent to credit card companies for transaction costs
  - Register Aircraft owners
    - 1600 aircraft in Dbase

Appendix A

- Testing Access
- Hardcopy registration forms sent
- $30 fee (average) (fees based on weight and age)
- Registration sticker sent

- Software:
  - ArcView 3.1 (one copy – purchased through KLJ)
  - Dbase (converting to Access)